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# ABSTRACT

# Lifetime versus Annual Tax Progressivity: Sweden, 1968–2009*

This paper analyzes the evolution of tax progressivity in Sweden from both annual and lifetime perspectives. Using a rich micro panel with administrative records of incomes, taxes and benefits over the period 1968–2009, we calculate tax rates across the income distribution accounting for different tax bases as well as the role of transfers. The uniquely long time span also allows us to compute tax progressivity as realized over a cohort's entire life cycle. Our main finding is that taxes are considerably less progressive over the lifetime than in any single year. In fact, life cycle taxes are close to proportional, bearing a redistributive effect of only a few percent. Intragenerational income mobility seems to be driving this result, although the Swedish economic crisis of the 1990s and the tax reforms of 1971 and 1991 are also important. Labor income taxes contribute less to progressivity in recent years, whereas transfers to unemployed and old-age pensioners have become increasingly important. These findings are robust to the use of different tax rates, tax bases, sample populations, rates of discounting and controls for reranking.

JEL Classification: D31, H20

Keywords: tax progressivity, income distribution, lifetime income, redistributive effect, Kakwani index, transfers

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## 1. Introduction

A fundamental problem with conventional assessments of tax burdens is that they typically rely on annual cross-sectional outcomes. Incomes vary over the life cycle, with young people often being low-income earners regardless of whether they will be high-paid surgeons or low-paid clerks in the future. Old-age pensioners typically do not pay payroll taxes, even though they may well earn more than younger individuals in the labor force. Capital gains are typically observable and taxed when they are realized rather than when they accrue, and such one-shot realizations may not accurately depict the lifetime income status or lifetime tax burden. Accounting for lifetime variations in both income and the ability to pay taxes is important for making a balanced assessment of the trade-off between the equity and efficiency of the tax system.

In this paper, we analyze the implications of studying tax progressivity in an annual versus a lifetime perspective. We do this by exploiting a rich data source with register information on the taxes paid and benefits received by a large and nationally representative sample of individuals. Using a panel covering a 42-year period, we are able to compute measures of "lifetime tax progressivity", relating information about *actual* lifetime tax payments and *actual* lifetime incomes for various parts of the distribution of lifetime incomes. The use of such a long panel appears to be a unique contribution to the literature. Previous studies of the redistributive impact of taxes over one's lifetime have typically been based on either simulation methods or much shorter panels. In particular, our work extends the previous work on tax progressivity using microdata, which started with Pechman and Okner (1974) and features subsequent contributions by Davies, St-Hilarie and Whalley (1984), Slemrod (1992), Fullerton and Rogers (1993), Cameron and Creedy (1999), Creedy and van de Ven (2001), and, on Swedish data, Björklund, Palme and Svensson (1995).[1] The richness and size of our data – a sample size of approximately 200,000 individuals per year – allow us to compare narrow income segments at the top of the income distribution, such as percentiles and tenths of percentiles. Such focus is of particular relevance when pinpointing the differing impacts of labor and capital taxation.

[1] There is a related and more extensive literature analyzing income inequality over annual and lifetime horizons, paying little or no attention to taxation and tax progressivity (see Creedy, 1999, for an overview). Studies of Sweden include Blomquist (1981), Björklund (1993), Hussenius and Selén (1994), Björklund and Palme (2002) and Pettersson and Pettersson (2003).

Another contribution of our paper is providing a comprehensive assessment of how the redistributive properties of the Swedish tax system have evolved in recent decades. The Swedish tax system has undergone major changes over the past 40 years. The overall tax burden has increased, and government tax revenues have gradually become more dependent on social security contributions and value-added taxes. Some specific reforms are particularly noteworthy. In 1971, the traditional system with joint taxation of married couples was replaced by a system in which each spouse pays taxes on his or her own income. The tax reform of 1991, called the "tax reform of the century" for its groundbreaking impact, involved substantial cuts in marginal income taxes along with the introduction of a dual income tax system in which earned income and capital income are taxed at different rates. More recent reforms include the abolition of the wealth tax as well as the introduction of a system with earned income tax credits.

We compute measures of average tax rates, typically net of transfers, for various segments of the income distribution and examine how these rates change over time, noting that the effective degree of tax progressivity depends on the composition of the tax base as well as the statutory tax rates. We also compare the contribution of different taxes, such as the income tax, the payroll tax, the wealth tax and the value-added tax, to the overall level of tax progressivity. Thanks to the comprehensive coverage of our data, we are able to pay particular attention to the progressivity of taxes and transfers at the very top of the income distribution, extending the work on tax progressivity among top income earners in the U.S., the U.K. and France (Piketty and Saez 2007).

Several important results emerge from the analysis. First, we find that lifetime tax progressivity is lower than tax progressivity in almost any single year. This finding is primarily due to the considerable within-life redistribution, where, e.g., the amounts received as student or old-age support almost offset the taxes as income earner.[2] Our empirical longitudinal evidence thus reinforces much of the previous simulation evidence on life cycle progressivity. Second, we show that the discrepancy between annual and lifetime tax progressivity reflects the transitory nature of low-income status rather than the transitory nature of high income. Many of the individuals earning low or zero market income thus do not permanently belong to the bottom of the income distribution; they can be workers who are temporarily outside the labor market,

[2] This finding gives empirical backing to the proposal of Bergh (2005) that the redistributive achievements of the welfare state cannot be assessed only from comparing annual cross-sectional pre- and post-fisc distributions.

unemployed, in educational programs or on sick leave. These individuals appear to be greatly "favored" by the tax-cum-benefit system when using annual data as opposed to lifetime estimates. By contrast, transitory high-income shocks, such as those caused by large realized capital gains, fall mainly on those who have already high permanent incomes. At the top of the income distribution, annual progressivity estimates therefore correlate highly with lifetime tax burdens.

Third, we document the evolution of Swedish tax progressivity and find that it has followed an inverted U-shape over the past four decades, increasing sharply in the 1970s and dropping in the 1990s and 2000s. The exact characterization of the experience depends on how transfers are treated. When only actual taxes are considered, the primary source of the variation in progressivity appears to be changes in the tax system, in particular the tax reforms of 1971 and 1991, rather than trends in the distribution of market incomes. The dramatic rise in unemployment – and thus associated transfers – during the economic crisis of the 1990s increased the degree of tax-and-transfer progressivity. Comparing Sweden's experience with progressivity with that of Great Britain and the U.S., taxes in Sweden appear less progressive, primarily due to the high levels of income and payroll taxes paid by low-income earners. Fourth, our decomposition of tax bases, in which we include not only different income taxes but also payroll, wealth and consumption taxes, reveals drastic restructuring over the study period. In particular, payroll taxes have become increasingly important, whereas capital taxation (including taxes on capital income, real estate, and wealth) has diminished substantially.

The remainder of the paper is structured as follows. Section 2 offers a brief overview of some key features of the Swedish tax system. In section 3, we discuss the basis of comparing annual and lifetime outcomes and discuss various measurement issues. Section 4 is devoted to a study of the evolution of tax progressivity by means of cross-section and panel data with information on incomes and tax payments. Section 5 concludes the paper.

## 2. The Swedish Tax System

The total Swedish tax-to-GDP ratio stood at 40 percent in 1970 and has hovered at approximately 50 percent during the 2000s. Sweden used to have the highest tax-to-GDP ratio in the world, but this position has in recent years been overtaken by Denmark. In fact, the Swedish tax-to-GDP ratio has fallen by four percentage points since 1990. It should be noted that most

transfers, such as pensions and social insurance benefits, are treated as taxable income in Sweden, a fact that tends to exaggerate differences relative to countries where benefits are tax exempt.

Taxes on labor are the most important source of tax revenues, accounting for more than half of the total revenues. These taxes include personal income taxes to central and local governments as well as social security contributions paid by employers. The local government income tax rate is proportional and stood at 20 percent of taxable income on average in 1970, increasing to 31 percent by 2008. Since 1991, the central government income tax has only been applied to incomes above a threshold; approximately 20 percent of income earners are subject to the state tax, which has two brackets set at 20 and 25 percent.

Payroll taxes, or social security contributions, are paid by employers in Sweden. The standard rate of these taxes amounted to 11.6 percent of the wage bill in 1968. By 2009, the standard rate stood at 31.4 percent. However, these contributions are not entirely equivalent to taxes, as they are partially matched by increased benefit entitlements, such as higher retirement benefits. The social contributions have been proportional to the wage bill since 1982 (although with some age variation from 2006 onward). However, before 1982, contributions were markedly nonlinear with earnings, having low rates for low earnings, higher rates for intermediate earnings (the standard rate), and again, much lower rates for high earnings. The average payroll tax rate was thus higher than the marginal rate for workers with high earnings.

Taxes on consumption and input goods include a value added tax (VAT). By 2008, these taxes contributed more than one fifth of all tax revenues. The VAT was introduced in 1969, with the standard rate then set at 11 percent; however, several services were exempted from the VAT. Since 1991, the standard VAT rate has stood at 25 percent of the tax base. The effective VAT rate is much lower than the standard rate, as some goods and services are taxed at lower rates (6 or 12 percent), with others exempt from taxation. There are also a few excise taxes, which in total account for almost 8 percent of tax revenues in 2008. These taxes include “sin” taxes on alcohol and tobacco as well as taxes on energy, carbon and motor vehicles.

From 1991 onward, Sweden has practiced a dual income tax system featuring separate rules for earned income and capital income. Individual capital income (interest, dividends and capi-

tal gains) is subject to a proportional income tax of 30 percent.[3] The corporate income tax is 28 percent of net taxable profit as of 2008. Inheritance and gift taxes were abolished in 2004, and the wealth tax was abolished in 2007. In 2008, the property tax on real estate was abolished and replaced by a municipal property charge, a reform that substantially reduced property taxes for more expensive residences. As of 2008, capital taxes accounted for 11 percent of all tax revenues.

A recent innovation of the Swedish tax system is the introduction of an earned income tax credit in 2007. This reform reduced marginal taxes on low incomes by raising the income threshold for income tax liability. A noteworthy feature of the reform is that the lower taxes apply only to earned income and not to transfers, such as pensions or unemployment and sickness benefits. The reform thus increases the after-tax difference between income from work and non-work income.

## 3. Measuring Annual and Lifetime Incomes, Taxes and Progressivity

The rationale behind making lifetime estimates of income inequality and tax progressivity is that the same individuals tend to appear in different tails of the income distribution in different years. Annual snapshots of tax progressivity therefore capture both redistribution between individuals within years and redistribution across years for the same individuals. The intrapersonal redistribution reflects in part the insurance elements in the tax system.[4]

Regarding the transitory nature of incomes, it is well known that lifetime incomes are more equally distributed than annual incomes (for an early treatment on Swedish data, see Blomquist 1981). Part of this finding is because the cross-sectional distribution of income captures differences between younger individuals who have recently entered the labor market, experienced workers, and seniors who have left the labor market. In welfare states, a tax on labor income effectively distributes income from those who are in the labor force to those who have not yet entered it and those who have left it. A related issue is the role of capital gains. On tax records, capital gains appear in a very lumpy manner, placing at the top of the income distribution some individuals who do not regularly show up there. From a permanent

[3] The effective capital gains tax rates have varied somewhat, e.g., with cuts in the early 1990s and a generally lower effective rate on real estate sales (only two thirds of such taxable gains).
[4] See also Fullerton and Rogers (1993) for a comprehensive discussion.

income perspective, capital income gains should be measured when they accrue rather than when they are realized. If capital income realizations temporarily place individuals at the top of the income distribution and if capital income gains are taxed less heavily than labor earnings, the annual estimate of tax progressivity will appear regressive at the top compared to the lifetime perspective.[5]

The second dimension of lifetime progressivity pertains to the role of social security. In any given year, the bottom of the income distribution includes individuals who are temporarily out of work (being, e.g., sick, unemployed or on parental leave). Transfers directed at these individuals will reinforce the effect of a strong degree of annual tax progressivity. The annual average tax rate at the bottom of the annual income distribution would be zero, whereas the "effective" tax rate, which defines transfers as negative taxes, would be negative (see below for a discussion of these concepts). However, to the extent that social security transfers are paid *and* received by the same individuals, the tax and transfer system will appear less progressive from a lifetime perspective. In Sweden, replacement rates have occasionally been approximately 90 percent, which means that every unit of currency collected in social security implies a close to a one-to-one increase in expected benefit. Some analysts thus regard the payroll tax as an actuarially fair insurance premium rather than a tax. In practice, however, the social security system contains caps, exceptions and eligibility constraints, making it much less "fair" in an actuarial sense and more tax-like. Annual estimates of tax progressivity must thus make an ex ante stand on how much of the payroll tax is really a "tax", which is a very delicate task (see, e.g., Sørensen, 2010, p. 211). In contrast, lifetime payroll taxes "net out" taxes that are transferred to the same individual automatically.[6]

The distinction between horizontal redistribution (across time) and vertical redistribution (across individuals) is also related to our understanding of the rise of the modern welfare state. From a political economy perspective, insurance elements in the tax-and-transfer system can justify public sector spending; social insurance, if properly designed, can be less distortionary than redistributive taxes with high marginal tax rates. Drawing partly on this idea, Lindert (2004) notes that countries with a high share of public spending relative to GDP (such as Sweden) have traditionally had a more proportional tax system, at least compared to the

[5] For this reason, Piketty and Saez (2007) rank tax units based on income net of capital gains (and then add capital income gains back when calculating the tax rates).
[6] See also the distinction between insurance and redistribution in Hoynes and Luttmer (2011).

Anglo-Saxon countries. The emphasis on social security as characterizing states with high public expenditures is also consistent with the canonical taxonomy of welfare capitalism, where Scandinavian welfare states are characterized by a high level of universality and limited reliance on markets and families (Esping-Andersen 1990). However, as noted above, the actual incidence of social security and insurance elements in the tax-and-transfer system requires lifetime data.

### 3.1 Tax Rates

In our progressivity analysis, we wish to describe how average tax rates vary by income. To serve this aim, we consider two measures of average tax rates. The first measure, arguably the more conventional of the two, is pre-tax total income, which relates total tax payments to the tax base. In Sweden, the tax base includes market income as well as taxable transfers such as unemployment benefits and sickness benefits. We thus have

$$t_i = \frac{T_i}{Y_i + B_i} \quad (1)$$

where $T_i$ represents total tax payments, $Y_i$ is pre-tax market income (also referred to as gross income or simply market income) and $B_i$ represents taxable transfers; subscript *i* refers to individual *i*. We shall refer to the sum of $Y_i$ and $B_i$ as *pre-tax total income* or taxable income.

This measure, referred to as the *average tax rate* (ATR), is conventionally referred to in international comparisons, but it suffers from a number of conceptual shortcomings in the measurement of progressivity. First, the ATR does not directly account for the redistributive effects of transfers, which can be disproportionally targeted to poor individuals. As such, it is conceptually difficult to regard transfers $B_i$ as part of the tax base, as the ATR is in turn a function of $Y_i$. Taxable transfers and market income are perfect substitutes in the short run, so from an annual perspective, this need not be a severe issue. However, from a lifetime perspective, calculating the average tax rate in this fashion is problematic. By adding taxable transfers $B_i$ to market income $Y_i$, pre-tax total income effectively double-counts transfers within the social security system.

A second, more comprehensive, measure is the *effective tax rate* (ETR), which not only includes taxes paid but also transfers received, noting that transfers are in principle *negative taxes*.[7] The ETR is in this way a function of disposable income relative to gross income and is defined as

$$t_i^e = \frac{Y_i - D_i}{Y_i} \quad , \tag{2}$$

where disposable income $D_i$ includes after-tax income from labor and capital as well as after-tax transfers (including transfers that are not taxed). The ETR takes into account that the tax-cum-benefit system becomes more progressive if transfers are disproportionately targeted at individuals with low incomes. Effective tax rates will typically be negative for individuals with very low pre-tax incomes. If no upper age limit (at retirement age) is imposed, elderly individuals who receive pensions (which are essentially transfers and thus are not included in market income) will often obtain negative ETRs when using annual figures. ETR goes to infinity as market income approaches zero and is not defined for individuals without any market incomes.

Gross (market) income is obtained as

$$Y_i = Y_i^w\left(1 + t_i^p\right) + Y_i^k \quad , \tag{3}$$

where $Y_i^w$ is earned income, $t_i^p$ is the payroll tax rate and $Y^k$ is income from capital. Disposable income is written as

$$D_i = (1 - t_i^w)Y_i^w + \left(1 - t_i^k\right)Y_i^k + (1 - t_i^w)B_i + Z_i \quad , \tag{4}$$

where $t^w$ is the income tax rate applied to earned income, $t^k$ is the tax rate on capital, $B_i$ represents taxable transfers, and $Z_i$ represents transfers that are not taxed. From (4), we derive the following:

[7] The analysis of the progressivity of taxes net of transfers is not a new concept but has previously been carried out in a more general framework in which all of the government's redistributive expenditures are considered (see Lambert, 2001, ch. 11).

(5) $$D_i = (1 - t_i^w)(Y_i^w + B_i) + \left(1 - t_i^k\right)Y_i^k + Z_i \, .$$

Using (2), (3) and (5) yields ETR as follows:

(6) $$t_i^e = 1 - \left(\frac{(1 - t_i^w)Y_i^w + \left(1 - t_i^k\right)Y_i^k + (1 - t_i^w)B_i + Z_i}{Y_i^w\left(1 + t_i^p\right) + Y_i^k}\right),$$

whereas ATR is obtained as:

(7) $$t_i^e = \frac{t_i^p Y_i^w + t_i^w(Y_i^w + B_i) + t_i^k Y_i^k}{Y_i^w\left(1 + t_i^p\right) + Y_i^k + B_i} \, ,$$

where disposable income is defined by (5). All else being equal, an increase in transfers implies a decrease in ETR, as transfers increase disposable income. An increase in untaxed transfers increases ATR by increasing disposable income. An increase in taxable transfers has in general ambiguous effects on ATR, as $B_i$ appears both in the numerator and the denominator of (7).[8]

### 3.2 Lifetime Incomes and Taxes

We use a standard approach to measuring lifetime incomes and tax burdens, namely by calculating present values of the streams of incomes and taxes over the individual's entire life cycle, using the observed data points in the income tax registers. The present value of income measured over $T$ years is defined as follows:

(8) $$Y_i^{life} = \sum_{s=1}^{T} Y_s(1 + r)^{-(s-1)} \, ,$$

where $s$ is the year and $r$ is a discount rate that reflects that incomes and taxes have more of an effect earlier in the life cycle. In our benchmark measures, we use a three percent annual discount rate. This discount rate is chosen to reflect the average real interest rate during the

[8] These exercises take the various tax rates as fixed. We have the following: $sign\frac{\partial t_i}{\partial B_i} = sign\left[-(1 - t_i^w)t_i^p + tiw{-}tik(YikYiw)\right.$.

A negative impact is most likely except for individuals with a very large share of their income derived from capital.

period of analysis and is also a standard rate used in previous studies on Sweden (see, e.g., Blomquist, 1981).

Lifetime tax rates are obtained by taking the ratio of the discounted lifetime incomes and taxes using equation (8). In other words, the denominator and numerator in (6) and (7) are summed separately before the tax rate is calculated.

The incidence of taxes is assumed to be the same in the annual and lifetime perspectives for comparability reasons. However, in the case of payroll taxes, this assumption is potentially problematic because payroll taxes are sometimes regarded as mainly falling on employers in the short run and on employees over the long run. Capital income is another difficult concept in our analysis. We include interest earnings, dividends and capital gains in both annual and lifetime incomes, but this is not an obvious choice, as capital income largely reflects how much of their income people save and consume. In a standard life cycle model, in which people typically consume all of their wealth, lifetime capital incomes and taxes are thus problematic concepts. However, to the extent that observed capital incomes also reflect inheritances, as recently pointed out by Piketty and Saez (2012), such a conclusion no longer holds.

### 3.3 Measuring Tax Progressivity

Tax progressivity is a multi-faceted concept. Two central notions of a progressive tax schedule are that taxes have an equalizing effect on the distribution of incomes and that higher incomes are associated with higher tax rates. For this reason, when characterizing progressivity, a distinction is often made between the *redistributive capacity* of the tax system and its *departure from proportionality*.[9] The former aspect refers to the impact on income dispersion that taxes and transfers have, reflected by the difference between pre- and post-tax incomes (Reynolds and Smolensky, 1977). The latter aspect of progressivity relates to the distribution of tax burdens and the extent to which the tax rates across the distribution depart from a sole proportional tax rate (Kakwani, 1977, 1984).[10] Both measures are founded on Lorenz curve representations and thus offer solid linkages to welfare theory.

[9] See Lambert (2001, chapters 8 and 11) for a comprehensive presentation of tax progressivity measurement.
[10] As was originally shown by Kakwani (1984) and later extended by Aronson, Johnson and Lambert (1994) and Lambert and Urban (2008), the Reynolds-Smolensky redistributive effect can be decomposed into two components: the Kakwani index of disproportionality multiplied by the average tax rate and the reranking effect.

Our analysis draws on both of these progressivity measures. The Reynolds-Smolensky measure, denoted as $\Pi^{RS}$, tells us the degree to which income inequality is reduced by the tax schedule. This measure is defined as the difference between the market income Gini coefficient $G_Y$ and the disposable income Gini coefficient, with income earners ranked according to market incomes, $G_D$:

$$\Pi^{RS} = G_Y - G_D \quad . \tag{9}$$

The other progressivity measure is Kakwani's index of the departure from proportionality of the tax, $\Pi^K$. This index is measured as the difference between two variables, the first of which is the dispersion of tax liabilities, measured as the concentration coefficient for effective tax payments, $C_{Y-D}$. This coefficient is the equivalent of the Lorenz curve, where income earners are ranked according to income on one axis and according to tax payments on the other. The second variable is the Gini coefficient for pre-tax incomes, $G_Y$. Next, $\Pi^K$ is defined as follows:

$$\Pi^K = C_{Y-D} - G_Y \quad . \tag{10}$$

Kakwani's index thus offers a measure of the amount of the tax burden that is shifted from low-income earners to high-income earners due to progressivity. The concepts of the redistributive effect and disproportionality are closely related, as shown by, e.g., Lambert (2001). If a tax schedule becomes more disproportionate, people with higher incomes pay relatively higher taxes, which shifts their post-tax incomes down. Through their Lorenz curve foundations, it can be shown that the redistributive effect equals the disproportionality of taxes times the tax level (defined as $t/(1-t)$, where $t$ represents total taxes divided by total income) less a so-called reranking effect $R$. Reranking occurs when taxes treat incomes – or income earners – differently, e.g., taxing capital income at a lower rate than labor income regardless of their respective amounts.[11] In all, the relationship between the redistributive effect $\Pi^{RS}$ and the disproportionality $\Pi^K$ can be stated as follows:

[11] Jenkins (1988) and others have shown that reranking can bias the estimation of the redistributive effect and progressivity. In our robustness analysis, we calculate the extent of reranking and discuss its importance to our findings.

(11) $$\Pi^{RS} = \frac{t}{1-t}\Pi^{K} - R \quad .$$

### 3.4 Data

Our main data source is a longitudinal database, LINDA, which is a 3.35 percent random sample of the Swedish population. LINDA is based on a combination of different public registers, such as income tax registers and population censuses.[12] These data are available from 1968 and onward, and we focus on the period from 1968–2009. In addition to providing rich information on income, the data include information on tax payments for most tax bases and deductions.[13] There is also information on some human capital attributes and demographic characteristics, such as age, gender, education and marital status.

We focus on individuals aged 20 and over. Using the individual as the unit of analysis is deliberate based on the Swedish tax system having been individual-based since 1971.[14] More importantly, however, we study lifetime incomes and lifetime taxes. Defining a corresponding "lifetime household" would be difficult because most people's household structure changes several times over the life cycle. The sample is representative for the total population each year except for the period from 1968–1970 due to missing information on residence (see below). The data consist of approximately 180,000 to 240,000 observations per year.[15] A small number of duplicate errors in the early period (1968–1974) were omitted.

Our analysis provides a lifetime approach on tax progressivity by focusing on individuals aged 20–40 in 1968. We follow this cohort for 42 years and rank the individuals on the basis of their lifetime real incomes, i.e., incomes over the period 1968–2009. Therefore, in 2009, these individuals are between 62 and 82 years old, depending on whether we restrict the sample to include workers only or include the full population.[16] Lifetime tax payments are applied to lifetime incomes to obtain lifetime average tax rates by lifetime income category. As al-

[12] For a description of LINDA, see Edin and Fredriksson (2000).
[13] We use supplementary historical tax rate information for the calculation of payroll taxes and VAT (see further below).
[14] Since 1971, all income taxes (and deductions) and most transfers have been individual. Wealth and consumption taxes and a few transfers (child allowances) are household-based. In the register databases, however, these taxes and transfers are split between the adults in a household.
[15] In four instances during the late 1980s, we drop an extremely rich individual who realized abnormally high capital gains, having a dramatic impact on the annual cross-sectional results. To aid robustness, we have run the analysis without the three richest individuals over the full period. The results are virtually the same and available upon request.
[16] We do not require the survival of all individuals in the panel up to 2009; a deceased person contributes zero to lifetime income.

ready mentioned, we discount the future incomes and taxes by a rate of three percent annually.

We measure our main income concept, *pre-tax market income*, as the sum of earnings from employment and self-employment and income from capital, including capital gains. This concept does not include social insurance transfers and pensions, but it does include employer-paid benefits, such as sick pay for short spells of absence.[17] Among earnings, we include an imputed payroll tax, reflecting an assumption that the burden of payroll taxes levied on employers is ultimately borne by workers. Therefore, transfers in the social insurance system are counted as market income when they are collected and not when they are paid out. Capital income is defined as the sum of interest payments, income from owner-occupied housing, dividends and capital gains.[18] Capital income is never negative (therefore, we do not subtract losses from total income).[19] Finally, pre-tax market income also includes the imputed value of owner-occupied housing for those who pay real estate taxes (i.e., those who own their houses).

We also define two other income concepts. *Pre-tax total income* is pre-tax market income plus taxable social transfers. Pre-tax total income reflects the conventional tax base definition and is used when calculating average, rather than effective, tax rates (see above). *Disposable incomes* include all transfers (including non-taxable transfers) net of VAT payments. Disposable incomes are reported in the income registers only from 1978 onward. We therefore compute them for earlier years back to 1968 by adding child allowances using statutory allowance levels.

Personal income taxes for each tax base are observed as they appear on tax records between 1971 and 2009. For the period 1968–1970, only the total sum of all personal tax payments is shown. To separate municipal and state income tax payments for these three years, we use the municipal statutory tax rates to impute the municipal income tax and then calculate the state income tax as a residual from the total income tax payment. Place of residence data were not

[17] The employer must provide sick pay for the first few weeks of sickness absence. Such sick pay is regarded as wage payments and is subject to payroll taxation. Longer periods of sickness absence are covered by sickness benefits provided by the national social insurance system.
[18] Income from owner-occupied housing is imputed by tax authorities before 1991 ("schablonmässig inkomst av annan fastighet") and by us thereafter, using the real estate tax payments as basis.
[19] We make this adjustment for comparative reasons, as capital incomes before 1991 were never negative but can be after 1991 due to the separate reporting of earnings/gains and losses.

observed until 1971, and the statutory municipal tax rates for 1969 were used for 1970 due to the lack of original data. Therefore, for the years 1968–1970, the sample is only representative for those living in Sweden in 1970.

Payroll taxes are levied on employers and imputed (see equation 3) using information on individual labor income and statutory tax rates in Söderberg (1996). The payroll tax rate is typically the same for all individuals but, as already noted, varied by earnings before 1982 and has varied by age sine 2006.

Before the tax reform in 1991, earnings, capital income and the imputed value of owner-occupied housing were taxed at the same rate. A special real estate tax was introduced in 1985, and the taxation of labor income and capital income was separated in 1991. Net marketable wealth, i.e., the sum of most real and financial assets less debts, was taxed at the household level until the abolition of the tax in 2007. We thus observe the value of owner-occupied housing up to 1990. From 1991 onward, we impute the value of owner-occupied housing for those who pay real estate tax.

Corporate income is typically not taxed at the personal level in Sweden and is therefore excluded from the analysis. However, we include income from sole proprietorships, which is registered at the individual level as business income and taxed together with other types of income. Inheritance and gift taxes existed in Sweden until 2004 but were taxed separately from income and thus were never registered by the income and tax database maintained by Statistics Sweden. Therefore, we do not account for inheritance taxes, but parts of inheritances, which appear as realized capital gains when heirs sell their inherited assets, are included in our data.

A more detailed discussion, including the original data labels used to construct the variables, is provided in Appendix 2.

## 4. The Evolution of Taxation in Sweden, 1968–2009

### 4.1 Average Tax Rates

We begin our analysis by providing a series of annual snapshots of the Swedish tax progressivity. In Figure 1, the evolution of average tax rates (ATR) is shown across income categories (In Appendix 1, Table A.1 presents a closer look at the most recent data in 2009, and Table A.2 presents a detailed analysis of tax rates between 1968-2009.) Several features stand out. There is a marked increase in tax rates for all categories up to 1990, but the tax rates increase faster at the top than at the bottom. The early 1990s show a sharp drop in progressivity, a development that is bound to have been mainly driven by the 1990–1991 tax reform. Finally, we note a regressive element in the tax system prevailing since the early 1990s: average tax rates are often lower at the very top than at income levels just below the top. This feature reflects in part the fact that the taxes on income from capital – a major income source at the top – are relatively low compared to taxes on earnings.[20]

[Figure 1 about here]

### 4.2 The Composition of Tax Bases

Which taxes contribute to progressivity? Figure 2 shows how the composition of taxes (disregarding transfers) has evolved over the time. Throughout the 42-year period of analysis, the income tax represents the most progressive element in the Swedish tax system. The wealth tax and the real estate tax have a trivial impact on the overall picture, despite being referred to as important redistributive elements in the Swedish transfer system. The payroll tax and the municipal income tax are proportional except at the bottom (where social insurance becomes a much more common source of taxable income) and top (where capital income becomes relatively important).

[Figure 2 about here]

### 4.3 International Comparison of Average Tax Rates in 1970 and 2004

To obtain a more complete picture of the Swedish experience, we also wish to examine how Sweden's income and wealth tax progressivity compare to the same tax progressivity in other Western countries. The comparison is based on the recent study of the progressivity of the

[20] Another reason for the lower tax rates at the very top are the relatively large deductions for interest expenses among the income-rich. Note also that we rank individuals based on the expression in the denominator in (6) and (7). Past work has subtracted capital income gains from total income before ranking (Piketty and Saez 2007), precisely to avoid having "transitory rich" individuals at the top. To ease comparison with lifetime measures of income, where such manipulations are unwarranted, we include capital income gains in the annual ranking.

U.S. federal tax system by Piketty and Saez (2007), in which the tax progressivity in France, Great Britain and the U.S. in 1970 and around 2004 are compared.

Figure 3 displays an interesting pattern. In 1970, Sweden had by far the highest average tax rate over the entire distribution, with the exception being the top 0.1 percentile. As we have shown above, this finding was due to the high income and payroll taxes paid by low-income earners. The graphical evidence suggests that progressivity (heuristically defined as the curvature of the graph) is lowest in Sweden and in France. The top marginal tax rates in Sweden increased rapidly after the 1971 tax reform up until unprecedented levels in the latter half of that decade.

[Figure 3 about here]

Looking at the 2000's, the structure of taxation has changed dramatically. Average tax rates are significantly lower across the board in all countries, including Sweden. Moreover, the degree of progressivity has also decreased in all countries. The decrease is most pronounced in the Anglo-Saxon countries but is also very evident in Sweden. Nonetheless, there remain differences in the composition of taxes paid, e.g., as regards the relative importance of payroll taxes in France and Sweden compared to other countries.

The primary finding is that income and wealth taxation schemes in Sweden appear to have converged to those of other Western countries in recent decades. In the 1970s, Swedish citizens both paid markedly higher taxes than elsewhere and experienced a highly progressive tax schedule. One generation later, this is no longer true, and Swedish taxes are aligned with those in France, Great Britain and the U.S. Although Sweden famously reformed its tax system in 1991, the convergence in tax schedules is driven as much by reforms in the UK, U.S. and France as by reforms in Sweden. [21]

### 4.4 Effective Tax Rates

As noted in section 3, a substantial fraction of tax payments are returned to taxpayers as transfers. Some of these transfers are intertemporal redistributions, e.g., social security taxes returned as pensions later in life. Transfers can offset non-progressive elements in the tax sys-

[21] In their study of German top average and marginal tax rates in recent years, Bach, Corneo and Steiner (2011) find a similar hump shape in tax rates over the top of the income distribution, as is observed in Sweden.

tem if they are targeted at the worse off. For instance, earlier evidence indicates that the increase in the child allowance in the early 1990s largely offset the regressive impact of the tax reform (Björklund, Palme and Svensson, 1995). These considerations call for a more comprehensive measure of tax progressivity, which regards transfers as "negative taxes" and adjusts the denominator to include only market income. Recall from Section 3 that the ETR is defined as one minus the ratio between disposable income (including transfers) and market income (excluding taxable transfers).

In Figure 4, the evolution of the tax-transfer system is shown as reflected by ETRs for selected income fractiles. The dispersion of ETR between the top and the middle of the distribution reaches a maximum in the early 1980s. As expected, the use of ETR does not differ much from ATR measures (Figure 1) at the top, where transfers constitute a negligible part of total income. However, the more comprehensive ETR measure produces lower tax rates even among the upper middle class.

Strikingly, the effective tax rates in the middle and the bottom *fell* dramatically in the early 1990s, a development triggered by the profound macroeconomic crisis that brought about a rise in unemployment from 2 to 10 percent between 1990 and 1993 and a fall in the employment-to-population rate by more than 10 percentage points. These events reduced effective tax rates via sharp falls in market incomes in conjunction with substantial increases in transfers to the non-employed.

[Figure 4 about here]

## 5. Annual versus Lifetime Tax Progressivity

In this section, we compare lifetime and annual measures of tax progressivity. We depart from an analysis contrasting a cohort aged 20–40 in 1968 with annual snapshots of progressivity using the full sample aged 20-64. In the robustness section, we extend the different samples to address comparability issues.

Figure 5 encapsulates the central empirical findings of the study and depicts the evolution of annual tax progressivity in Sweden since 1968 as well as the level of lifetime tax progressivity over the same period. Progressivity is measured as the redistributive effect ($\Pi^{RS}$) and dispro-

portionality ($\Pi^K$) of the effective tax rates incorporating both taxes and transfers (equation 2).[22]

Beginning with the assessment of Swedish annual tax progressivity, both measures exhibit an inverse-U shaped pattern over the past forty years. In the 1970s, progressivity roughly doubled, but it latter flattened out in the mid-1980s. During the 1990s and 2000s, progressivity exhibited a secular downward trend, reverting to the level of the mid-1970s. One specific finding is the spike in $\Pi^K$ during the early 1990s, depicted in the figure as "crisis effect". This effect stems from the Swedish economic crisis during this period, when mostly unemployment-related transfers sharply reduced effective tax rates, which in turn sharply increased the concentration of tax liabilities, $C_{Y-D}$, from 57 to 90 between 1990 and 1993. Over and above this crisis effect on the disproportionality of taxes, however, both progressivity measures follow the exact same time trend over the study period.

Lifetime tax progressivity is depicted as straight lines in Figure 5. The most immediate result yielded by comparing the annual and lifetime progressivity lines is that lifetime progressivity appears to be markedly lower than annual progressivity. In fact, it is lower than annual progressivity in virtually every year of the analysis. This confirms much of the theoretical predictions about life cycle taxation but remains noteworthy because of the remarkably low level of the redistributive effect of Swedish lifetime taxes, which is only marginally higher than in other countries' tax systems that previous studies have found to be close to proportional in the long run (see, e.g., Davies, St-Hilarie and Whalley, 1984; Slemrod, 1992; Fullerton and Rogers, 1993).

A second, almost equally striking, result shown in Figure 5 is the low level of the lifetime ETR progressivity. The redistributive effect is 0.105, equivalent to a 10 percent reduction in the Gini coefficient. To put this number into perspective, it is half of the 20-percent redistributive effect that Björklund (1993) found for Sweden during the period 1978–1990. It is possible that this finding reflects the effect of increasing the time window for measuring people's incomes. This figure is greater than the almost proportional 4–6 percent redistributive effect found for the U.S. by Slemrod (1992).

[22] All computations of progressivity and related measures are made using the PROGRES module in Stata (Peichl and van Kerm, 2007).

[Figure 5 about here]

What explains the finding that Swedish tax progressivity is so much lower over the life cycle than at the annual level? We can think of at least two plausible channels. The first concerns a difference in income inequality between the annual and lifetime horizons. Consider Figure 6, which shows Gini coefficients for market incomes before and after effective taxes over annual and lifetime horizons. Regardless of the concept of income used, lifetime inequality is lower than annual inequality, but the difference is most pronounced for pre-tax incomes. This finding is bound to reflect substantial income mobility in that low income in one year is partly offset by higher income in another year, thus implying a more even income distribution in the long run than in the short run. The life cycle contains periods during which people may be low income earners almost regardless of their lifetime income status, e.g., when they are students or retirees. This result is largely in line with previous studies comparing annual and longer-run income inequality, such as Blomquist (1981) and Björklund (1993) for Sweden and Slemrod (1992) for the United States.

[Figure 6 about here]

The second channel places more emphasis on the role of the tax system. Specifically, we wish to know whether annual tax burdens are the same as lifetime tax burdens across the income distribution. Part of the solution is provided in Figure 7, which presents both annual and lifetime effective tax rates of the top income quintile and the bottom four income quintiles. Its main result is that while taxes for the top income earners are roughly at the same level in annual and lifetime horizons, taxes paid by low and middle income earners differ quite markedly depending on time horizon. In particular, the lifetime tax rate for the bottom quintiles is almost twice as high as the annual tax rate. This pattern suggests, just as for income inequality, that the roots of the differential patterns of annual and lifetime tax progressivity emanate from the volatile incomes and resulting volatile tax burdens at the bottom of the income distribution.

[Figure 7 about here]

In Figure 7, we compare the effective tax rates between the top income quintile and the four bottom income quintiles (on this division, one can note that Robert Solow once proposed that

the 80th percentile marks the border between the "middle class" and the "upper class"; see Atkinson and Brandolini 2011). Figure 7 strengthens the evidence that it is "transitory poverty" rather than "transitory richness" that causes the discrepancy between annual and lifetime estimates of tax progressivity. This interpretation is consistent with the historical labor market development in Sweden, along with its large emphasis on social security. The substantial increase in unemployment in the early 1990s implied that large segments of the population earned zero market income. As the social security system took effect, individuals remaining employed were effectively taxed to smooth the disposable incomes at the bottom of the distribution. In contrast, the lifetime tax burden at the top is remarkably close to the annual tax burden for the same income segment. This pattern is consistent with previous research on the role of capital income gains in Swedish income inequality (Roine and Waldenström 2012); capital income gains appear to fall on the same people from year to year.

As a final piece of evidence, we inquire the role of the different tax bases for annual and lifetime progressivity. Table 1 presents average annual ATRs and lifetime ETRs for different income classes and four individual tax bases: municipal income taxes, state income taxes, payroll taxes and wealth/property taxes. By comparing these tax rates across the income distribution, we obtain a crude idea of the role of the tax base composition. However, this analysis is problematic because many low-income earners lack a market income but pay taxes on their transfer incomes (which are taxable in Swedish tax law). Consequently, annual ETRs become very high for low income levels as their income denominator approaches zero, and to mitigate this, we choose ATRs when assessing annual rates but use the more coherent ETRs for the lifetime perspective.

Income taxes are less progressive in the lifetime perspective than in the annual perspective, a finding that is largely in line with previous results for the U.S. (Davies, St-Hilarie and Whalley, 1984; Fullerton and Rogers, 1993). In the case of municipal taxes, which are paid by everyone, they are relatively more important to low incomes as expected but are somewhat less so in the annual perspective. This reflects the transitory nature of labor incomes. Similarly, state income tax rates, paid predominantly by high-income earners, are higher and more proportional in the lifetime perspective than in the annual perspective. The pattern is confirmed by the examination of payroll taxes. Payroll taxes are not paid by jobless people, but few people are jobless for their entire life. Payroll taxes are therefore proportional in the life-

time perspective, but very progressive at the bottom of the income distribution in the annual perspective.

Capital taxes, here captured by wealth and real estate taxes, show the reverse. These taxes are more progressive over the life cycle than at the annual level. This finding carries implications regarding the characteristics of high incomes. In any given year, a highly paid person may not be wealthy. As wealth accumulates over the lifetime, however, high-income earners are likely to be wealthy in the lifetime perspective.

[Table 1 about here]

## 6. Sensitivity analysis

### 6.1 Disregarding transfers

Our main analysis focuses on progressivity in the tax-transfer system, based on the premise that governments can choose to tax and then distribute transfers or to distribute transfers and then tax them, necessitating a comprehensive approach to measuring redistribution and taxation. However, the conventional approach in tax analysis has been to consider only the taxes paid and disregard transfers altogether, which is reflected in the ATR-based measures.

Figure 8 shows the evolution of annual tax progressivity (ATR), measured as the redistributive effect and disproportionality indices.[23] By and large, the main picture is quite similar to what was found in the above analysis of tax-transfer progressivity. However, there are also some notable differences. In terms of levels, ATR progressivity is markedly lower than ETR progressivity, reflecting the progressive nature of transfers. In terms of time trends, both measures of ATR progressivity exhibit an inverse-U shaped pattern that is similar (although not identical) to that found in tax-transfer progressivity. The 1970s observed a sharp increase in progressivity, with a peak occurring around 1980. During the 1980s, ATR progressivity fell steadily, and after the tax reform of 1991, when the redistributive effect dropped by one third, it reverted to the low level observed during the early 1970s, where it hovers for the remainder of the period under study. As noted in Section 2, the 1980s, ending with the large tax reform,

[23] Note that we only report annual ATR progressivity and not lifetime ATR progressivity, as the latter double-counts benefit income; i.e., it counts benefits both when they are paid in (as payroll taxes) and when they are paid out (as unemployment, sickness and pension benefits).

was indeed a period when the political system explicitly aimed to lower the highest marginal tax rates. Note also how the absence of transfers in the analysis implies that the economic crisis no longer gives rise to a spike in the disproportionality of taxes.

[Figure 8 about here]

### 6.2 Varying the rate of discounting

We do not know exactly how people think about their future. When determining rates at which income earners discount their future streams of income and taxes, researchers typically settle on numbers reflecting some long-run real rate of return in the economy. Our baseline analysis uses a discount rate of three percent, which is the unweighted average real rate of return on Swedish government bonds during the period under study.[24] However, one could conceive of situations in which people have different discount rates net of taxes, which would suggest that we have some variation over the income distribution. To address the potential effect of different discount rates, Figure 9 and Table 2 present the baseline analysis using either zero percent or six percent discount rates. This change has virtually no impact on the main findings. We thus conclude that our preferred discount rate is robust to reasonable alternative rates.

[Figure 9 about here]

[Table 2 about here]

### 6.3 Including the retired population

Our baseline analysis only includes people of working age (age 20–64). This is a fairly important restriction of an analysis of lifetime outcomes. However, we have run the core analyses using a broader sample, in which the old-aged pensioners are included. Figure 10 (and Table 2) shows the redistributive effect with and without retired people included in the population.[25] The main message of this figure is that our finding concerning a difference between annual and lifetime progressivity is reinforced. The annual redistributive effect nearly doubles

[24] Employing the same reasoning, Blomquist (1981) and Björklund (1993) also use three percent as their baseline discount rate.

[25] We cannot run the analysis using Kakwani's index of disproportionality because it breaks down as a result of the effective tax rate being close to zero, which is due to the large share of the population having zero market income and high transfer income. This instability in both sign and level as tax rates approach zero is a well-known and highly problematic feature of the Kakwani measure (see Lambert, 1985 and Lambert 2001, p. 235).

in level while maintaining its hump-shaped trend over the period under study. Meanwhile, lifetime progressivity increases only marginally, and the difference with the annual estimates is much larger than when only the working-age population is analyzed.

[Figure 10 about here]

### 6.4 The role of consumption taxes

One important tax base that has been excluded from the analysis thus far is consumption. This exclusion is mainly due to data constraints; consumption is only measured for a few households in a handful of years and thus is difficult to align with the rest of the administrative records used. Adding consumption taxes changes the analyzed income and tax concepts somewhat. In particular, letting $t^c$ be the VAT rate and $t^c D$ VAT-payments, disposable income in equation (5) is changed to

$$\widetilde{D}_i = \frac{1}{1-t^c}\left((1-t_i^w)(Y_i^w + B_i) + \left(1-t_i^k\right)Y_i^k + Z_i\right) \quad . \tag{12}$$

Moreover, the VAT-adjusted effective tax rate of equation (6) now becomes

$$\tilde{t}_i^e = 1 - \left(\frac{1}{1-t^c}\right)\left(\frac{(1-t_i^w)Y_i^w + \left(1-t_i^k\right)Y_i^k + (1-t_i^w)B_i + Z_i}{Y_i^w\left(1+t_i^p\right) + Y_i^k}\right) \quad . \tag{13}$$

To empirically analyze the role of consumption taxes for tax progressivity given the difficulties mentioned above, we resort to imputation. Specifically, we impute the VAT using information about effective VAT rates for consumers across different classes of disposable income as reported by Statistics Sweden. The effective VAT rates are lower than the standard rates because of tax differentiations and tax exemptions. We obtain effective VAT rates using data on aggregate VAT revenues along with data on private consumption. Note that we treat the tax rate as equal across individuals, even though differentiated VAT rates may arise due to differences in consumption patterns over the income distribution. Furthermore, we impute individual VAT payments by applying the VAT rate to disposable income, a procedure that underestimates progressivity because it ignores that top income earners typically consume at a level much lower than their disposable income.

Figure 11 shows how including VAT affects the main results of our study (see also Table 2 for numbers). For the first time, the two progressivity measures point in slightly different directions. Whereas the redistributive effect is hardly affected in the annual and lifetime perspectives, the disproportionality index is substantially reduced in both of these dimensions. However, this difference perhaps should not come as a surprise. The VAT is a proportional tax, which means that it does not redistribute heavily across households but does nonetheless have a large impact on the progressive income and wealth taxes. This finding is in line with previous studies on lifetime and annual consumption taxes. For example, using annual sales and excise taxes in the U.S. as measures of lifetime tax outcomes, other authors have found lifetime taxes to be less progressive than annual taxes (see, e.g., Poterba, 1989, Metcalf, 1994; Caspersen and Metcalf, 1994).

[Figure 11 about here]

### 6.5 The effect of reranking

As was described in the measurement section, the redistributive effect can be biased if there is a significant reranking of income earners between pre-fisc to post-fisc distributions (see, e.g., Jenkins 1988). We have therefore computed the size of reranking on the redistributive effect using ETRs. The result, shown in Figure 12 (and Table 2), suggests that reranking amount to roughly one quarter of the redistributive effect and that this is a relatively constant share over the period. From this finding, we conclude that although taxes and transfers do indeed make income earners switch places in the income distribution, this reranking is not quantitatively important enough to influence the overall conclusions regarding trends or the level of progressivity in Sweden.

[Figure 12 about here]

### 6.6 Using cohort population in annual cross-section

One potential concern with the comparison between annual and lifetime tax progressivity is that they are based on different sample populations; the annual outcomes use the entire population, whereas the lifetime estimations derive from a specific cohort. A reasonable question to ask would thus be whether the result of a difference between annual and lifetime outcomes remains when one also studies the annual progressivity of the specific cohort. Such a compar-

ison holds the sample constant but naturally suffers from the problem that the annual series will now be constantly changing with respect to the age profile and that in each year, the annual cross-section will not be representative of the population as a whole.

Figure 13 shows two panels with annual progressivity of both the full population and the cohort and the lifetime progressivity (where again only the cohort is used) for both progressivity measures. The main implication of this figure is that lifetime progressivity is markedly lower than annual progressivity for the cohort as well. In the case of the redistributive effect, there are six out of 42 years, predominantly during the beginning of the period, where the cohort's annual levels are somewhat lower than the levels over its entire life cycle. However, this result is the exception, and when noting the stark increases in progressivity in later years, especially when using effective tax rates, the overall finding remains intact. In the case of the disproportionality of taxes, the same consistency appears, indicating that even though the annual series follow quite different trends, the overall finding that lifetime progressivity is relatively lower continues to hold.

[Figure 13 about here]

## 7. Concluding remarks

All tax systems must strike a balance between the fairness of tax burdens across the distribution and the efficiency considerations inherent in all market-oriented economic activities. Most countries have more or less progressive tax systems, but the exact structure and composition of tax bases differ across countries and over time. If one wishes to comprehend to what extent a certain tax structure is equitable and efficient and whether this was sensibly designed by policymakers or the result of historical accident, a closer look at the long-run evolution of taxes and their progressivity is required.

In this paper, we have presented evidence on tax progressivity in Sweden, its evolution since the 1960s and, most importantly, novel estimates of tax progressivity over the entire working life cycle. The analysis also decomposes the determinants of progressivity across tax bases, especially labor earnings, capital income, wealth and consumption, and with respect to changes in the underlying distribution of market income.

Our main contribution concerns the estimation of life cycle progressivity. Whereas previous studies relied on either simulated observations or much shorter episodes, our 42-year panel allows us to relate lifetime tax payments to lifetime incomes for various parts of the distribution of lifetime incomes. We follow individuals from their labor market entry to their exit at age 60–70. The estimations show that lifetime taxes are substantially less progressive than taxes in any single year or shorter episode. This finding confirms much of the theoretical predictions about life cycle taxation but remains noteworthy because of the remarkably low level of the redistributive effect and disproportionality of Swedish lifetime taxes. We link the finding of less lifetime progressivity than annual progressivity to the higher income volatility and thus the volatility of tax burdens, among low-income earners. In particular, a large share of the annual low income earners are not low income earners over their entire lifetime, which means that their relatively low payroll taxes and large transfer benefits do not translate into similarly low taxes and high benefits over the life cycle. We propose that the insurance elements in the tax-and-transfer system, driven by the expansion of social security from 1960 onward, are central to understanding this result. Future research focusing more explicitly on the role of social security and horizontal redistribution would therefore be valuable.

We are also able to provide the first detailed picture of the evolution of tax progressivity in Sweden since the late 1960s. This is a highly significant period, both politically and economically, beginning just before the large tax hikes of the 1970s, continuing over the comprehensive tax reform of the 1990s and ending after the recent years' tax cuts in both labor and capital taxation. Our series portray an inverted U-shape of progressivity over this period, which fits with past fiscal policy events.

Finally, our analysis also shows that payroll taxes have become markedly more important in the taxation of Swedish incomes over the period under study. This is a pattern also found for other Western countries such as France and the U.K., and it potentially indicates an increased role in broad-based semi-visible taxes for the financing of modern welfare states. Furthermore, the role of capital taxation has decreased in Sweden, with this shift occurring around the time of the capital market deregulations and liberalizations in the late 1980s and 1990s. As was argued at the time and has been shown subsequently, greater mobility of (capital) tax bases implies downward pressure on tax rates.

## References


Aronson, J. R., P. Johnson, and P. J. Lambert (1994), "Redistributive effect and unequal tax treatment." *Economic Journal* 104(423), 262–70.

Atkinson, A. B. and A. Brandolini (2011), "On the identification of the 'middle class'", Ecineq Working Paper, 217.

Bach, S., G. Corneo and V. Steiner (2011), "Effective Taxation of Top Incomes in Germany", Discussion Paper 2011/18, Freie Universität Berlin.

Baum, S. (1987), "On the Measurement of Tax Progressivity: Relative Share Adjustment", *Public Finance Quarterly* 15(2), 166–187.

Baum, S. (1998), "Measuring Tax Progressivity: Compatible Global and Local Indexes", *Public Finance Review* 26(5), 447–459.

Bergh, A. (2005), "On the counterfactual problem of welfare state research: how can we measure redistribution?", *European Sociological Review* 21(4), 345–357.

Björklund, A. (1993), "A comparison between actual distributions of annual and lifetime income: Sweden 1951–89", *Review of Income and Wealth* 39(4), 377–386.

Björklund, A., M. Palme and I. Svensson (1995), "Tax reforms and income distribution: an assessment using different income concepts", *Swedish Economic Policy Review*, 2(2), 229–266.

Björklund, A. and M. Palme (2002), "Income redistribution within the life cycle versus between individuals: Empirical evidence using Swedish panel data", in: D. Cohen, T. Piketty and G. Saint-Paul (eds.), *The Economics of Rising Inequality*, Oxford, Oxford University Press.

Blomquist, S. (1981), "A comparison of distributions of annual and lifetime income: Sweden around 1970", *Review of Income and Wealth* 27(2), 243–264.

Cameron, L. and J. Creedy (1994), "Taxation and the distribution of lifetime income", In: *Taxation, Poverty and Income Distribution* (ed. by J. Creedy), pp. 140–162. Aldershot: Edward Elgar.

Caspersen, E. and G. Metcalf (1994), "Is a value added tax regressive? Annual versus lifetime incidence measures", *National Tax Journal* 47(4), 731–746.

Creedy, J. (1999), "Lifetime versus annual income distribution", In: *Handbook on Income Inequality Measurement* (ed. by J. Silber), Kluwer Academic Publishing.

Creedy, J. and J. van de Ven (2001), "Decomposing redistributive effects of taxes and transfers in Australia: Annual and lifetime measures", *Australian Economic Papers* 40(2), 185–198.

Davies, J.B., E St. Hilaire and J. Whalley (1984), "Some calculations of lifetime tax incidence", *American Economic Review* 74(4), 633–649.

Edin, P.-A. and P. Fredriksson (2000), "LINDA – Longitudinal INdividual DAta for Sweden", Working Paper 2000:19, Uppsala University.

Esping-Andersen, G. (1990), *The Three Worlds of Welfare Capitalism*, Princeton NJ: Princeton University Press.

Fullerton, D. and D. Lim Rogers, (1993), *Who Bears the Lifetime Tax Burden?*, Brookings Institution, Washington, DC.

Hussenius, J. and J. Selén (1994), *Skatter och socialförsäkringar over livscykeln - En simuleringsmodell*, ESO rapport, Ds 1994:135, Finansdepartementet, Stockholm.

Hoynes, H. W. and E. F. P. Luttmer, (2011) "The Insurance Value of Tax-and-Transfer Programs", *Journal of Public Economics* 95(11–12), 1466–1484.

Jenkins, S. (1988), "Reranking and the analysis of income redistribution", *Scottish Journal of Political Economy* 35(1), 65–76.

Kakwani, N. C. (1977), "Measurement of tax progressivity: An international comparison", *Economic Journal* 87(345), 71–80.

Kakwani, N. C. (1984), "On the measurement of tax progressivity and redistributive effect of taxes with applications to horizontal and vertical equity", *Advances in Econometrics* 3, 149–168.

Lambert, P. J. (1985), "On the redistributive effect of taxes and transfers", *Scottish Journal of Political Economy* 32(1), 39–54.

Lambert, P. J. (2001), *The Distribution and Redistribution of Income*, Manchester: Manchester University Press.

Lambert, P. J. and I. Urban (2008), "Redistribution, horizontal inequity and reranking: how to measure them properly", *Public Finance Review*, 36(5), 563–587.

Lindert, P. (2004), *Growing Public: Social Spending and Economic Growth since the 18th Century*. Cambridge, Cambridge University Press.

Metcalf, G. (1994), "The lifetime incidence of state and local taxes: measuring changes during the 1980s", in: J. Slemrod (ed.), *Tax Progressivity and Income Inequality*, Cambridge, Cambridge University Press.

Pechman, J. and B. Okner (1974), *Who Bears the Tax Burden?*, NY, Brookings institution.

Peichl, A. and P. van Kerm (2007), "PROGRES: Stata module to measure distributive effects of an income tax", Statistical Software Components S456867, Boston College Department of Economics.

Pettersson, T. and T. Pettersson (2003), *Fördelning ur ett livscykelperspektiv*, SOU 2003:110, Allmänna Förlaget, Stockholm.

Piketty, T. and E. Saez (2007), "How progressive is the U.S. federal tax system? A historical and international perspective", *Journal of Economic Perspectives* 21(1), 3–24.

Piketty, T. and E. Saez (2012), "A theory of optimal capital taxation", NBER WP #17989.

Poterba, J. M. (1989), "Lifetime incidence and the distributional burden of excise taxes", *American Economic Review* 79(2), 325–330.

Reynolds, M. and E. Smolensky (1977), *Public Expenditures, Taxes, and the Distribution of Income: The United States, 1951, 1960, 1970*, New York: Academic Press.

Roine, J. and D. Waldenström (2012), "On the Role of Capital Income Gains in Swedish Income Inequality", *Review of Income and Wealth*, forthcoming.

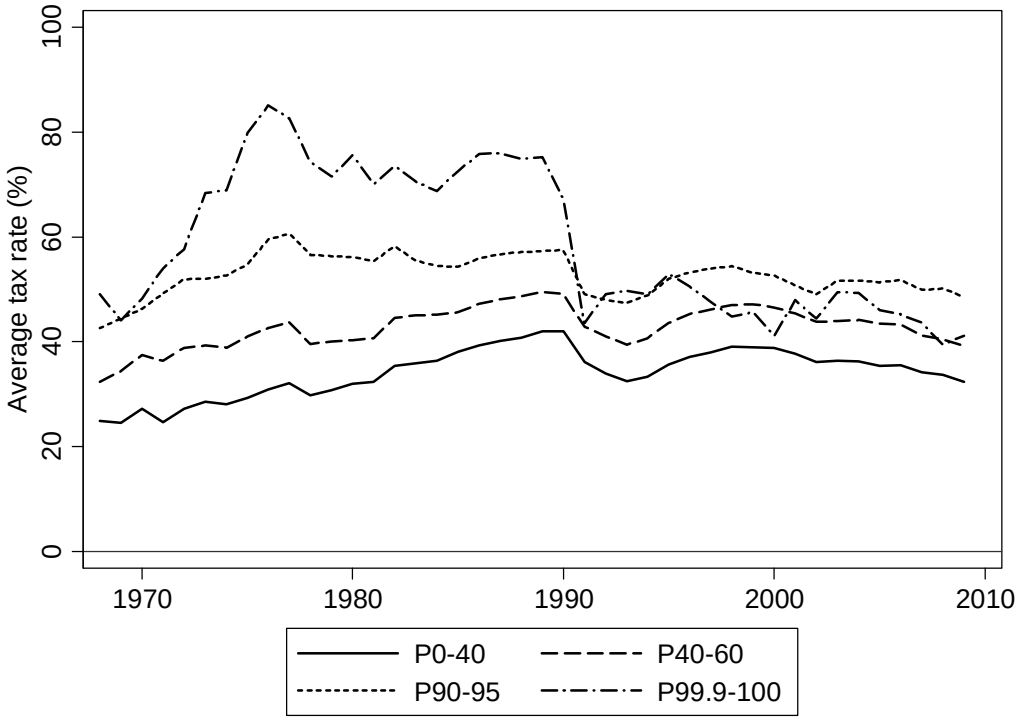
Slemrod, J. (1992), "Taxation and inequality: a time-exposure perspective", in: *Tax Policy and the Economy 6* (ed. J. Poterba), MIT Press.

Sørensen, P.B (2010), *Swedish Tax Policy: Recent Trends and Future Challenges*, Report to the Expert Group on Public Economics 2010:4, Stockholm, Fritzes.

Söderberg, H (1996), *Inkomstskattens utveckling under 1900-talet: en vägvisare för skatteberäkningar åren 1921–1996*, Stockholm, Skattebetalarna.

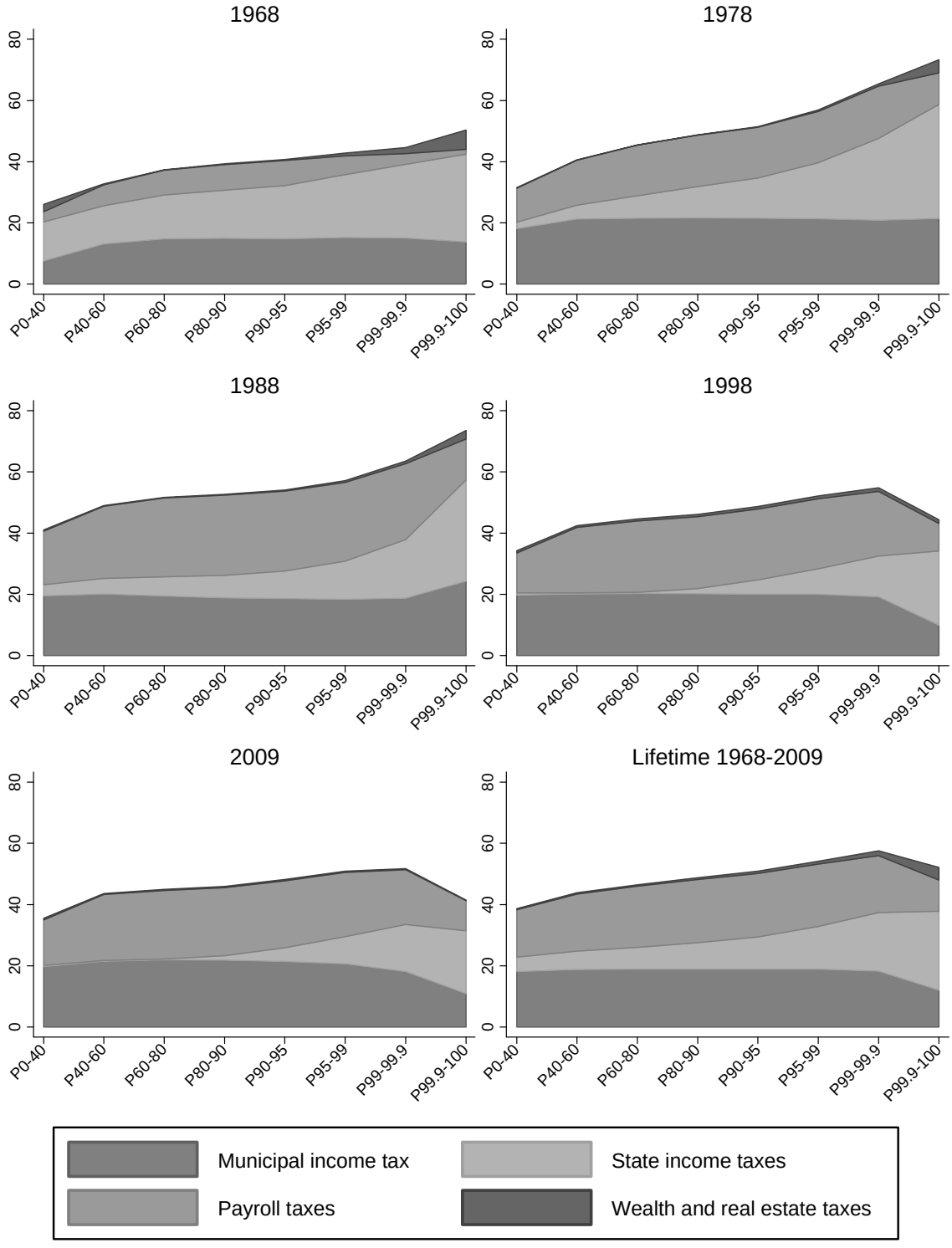
## Tables and Figures

Figure 1: Average tax rates (ATR) across the distribution, Sweden 1968–2009.




*Note*: Figure displays the average tax rate (ATR) across different income groups in Sweden between 1968 and 2009. Average tax rates are defined as total tax payments (net of exemptions and tax credits) divided by taxable income. Pre-tax total income includes market income and taxable social security transfers (see Appendix A2). Individuals are ranked according to pre-tax total income. Sample: Individuals aged 20–64 years.

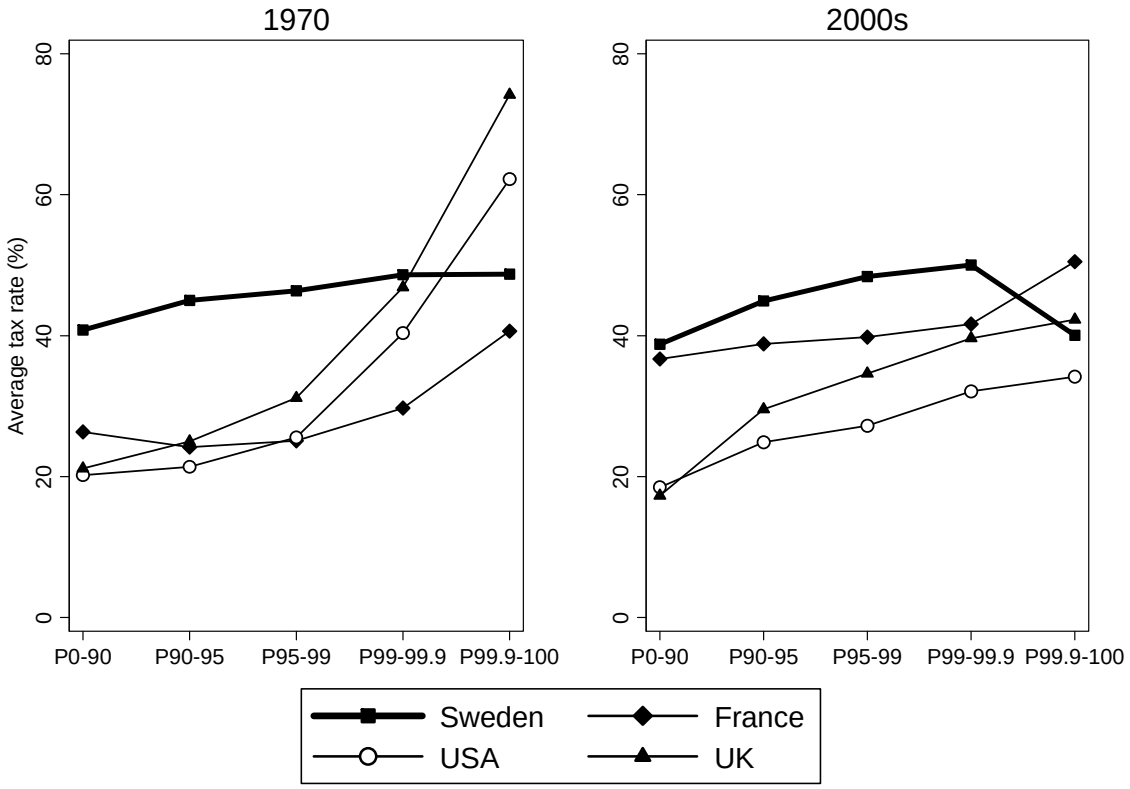
Figure 2: The composition of taxes across the income distribution in Sweden (by percentiles).




*Note*: Taxes are average tax rates (ATRs) in percent.

1. Annual figures (1968, 1978, 1988, 1998, 2009): Sample: age 20–64. Percentile ranking based on pre-tax total income.
2. Lifetime figure (Lifetime 1968-2009): age 20–40 in 1968, then kept until 65. Taxes are average tax rates (ATR) in percent. Percentile ranking based on pre-tax market income. Discount factor: 3 percent

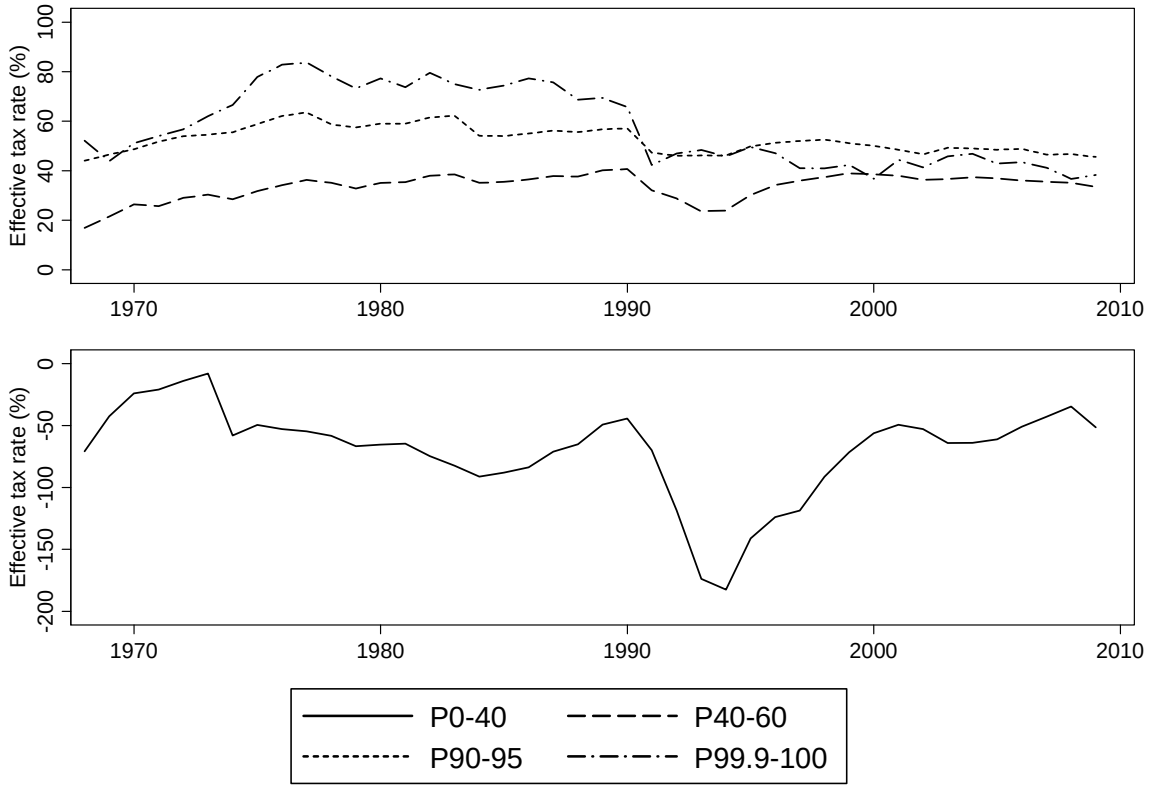
Figure 3: Tax progressivity in Sweden, France, USA and UK, 1970 and 2000s, by percentiles




*Note*: Right panel displays data from 2004 (France), 2005 (UK, USA) and 2009 (Sweden).

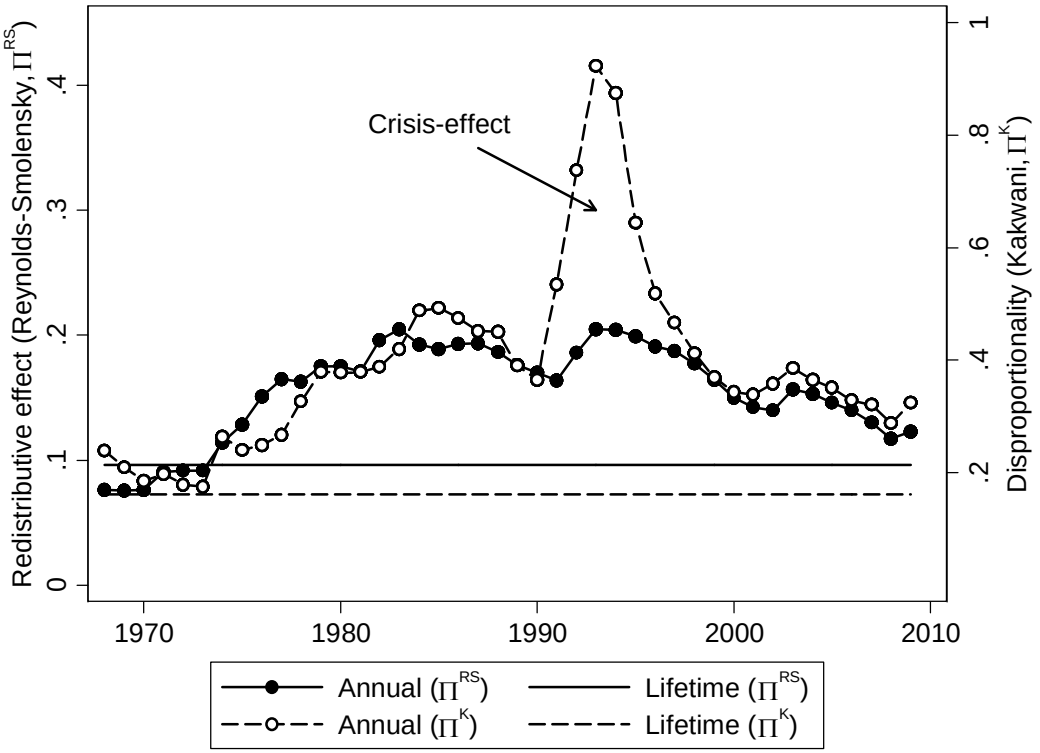
1) Sweden: The Swedish lines represent average tax rates, defined as total tax payments (net of exemptions and tax credits) divided by pre-tax total income. Sample: age 20–64. Percentile ranking based on pre-tax total income.
2) Non-Swedish numbers from Piketty and Saez (2007).

Figure 4: Effective tax rates across the income distribution, Sweden 1968–2009.



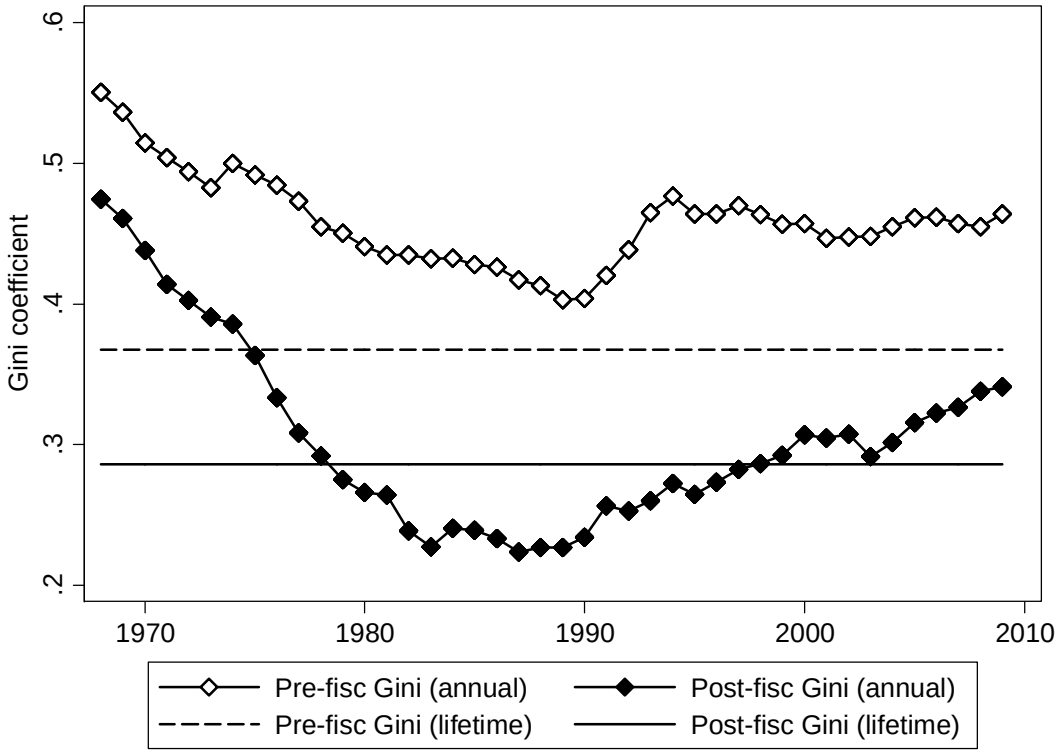

*Note*: Figures depict effective tax rates, defined as one minus the ratio between disposable income and pre-tax market income (see Appendix A.2 and the text). Percentile ranking based on pre-tax market income. Sample: age 20–64.

Figure 5: Annual and lifetime tax progressivity (ETR) in Sweden, 1968–2009.



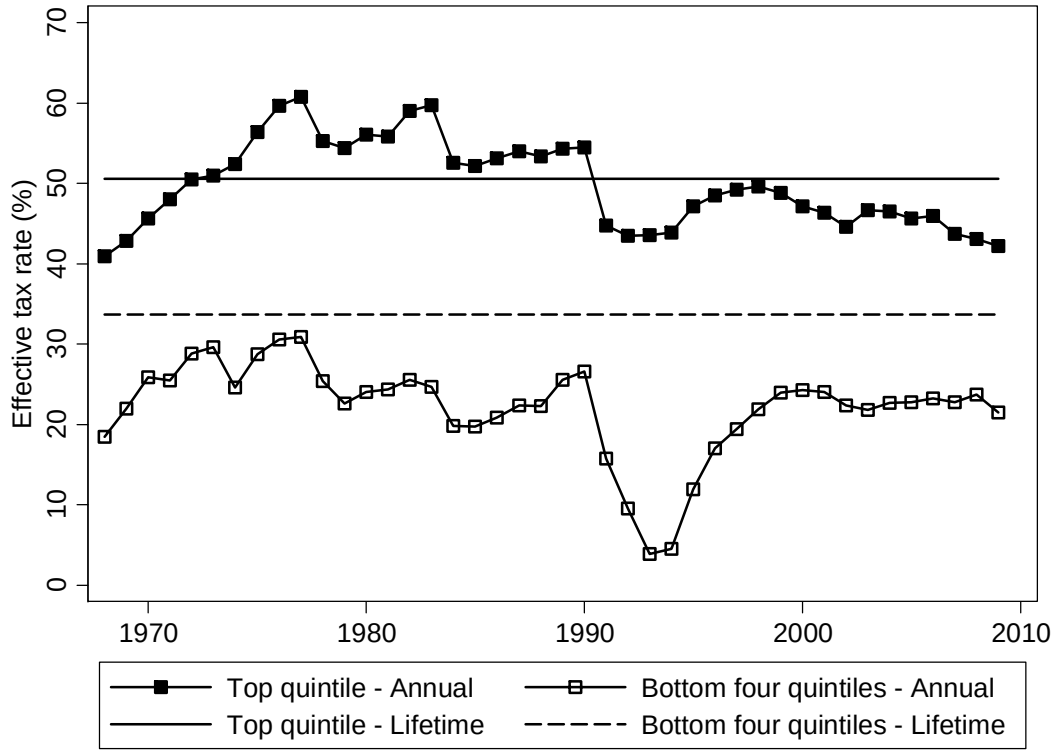

*Note*: Figures depict lifetime and annual measures of effective tax progressivity based on Reynold-Smolensky and Kakwani indices, calculated using pre-fisc incomes (pre-tax market incomes) and post-fisc incomes (disposable incomes). Annual sample: age 20–64. Lifetime sample: age 20–40 in 1968, then kept until 64. A 3-percent discount factor is used for the lifetime estimates.

Figure 6: Income inequality before and after redistribution: Lifetime vs. annual.



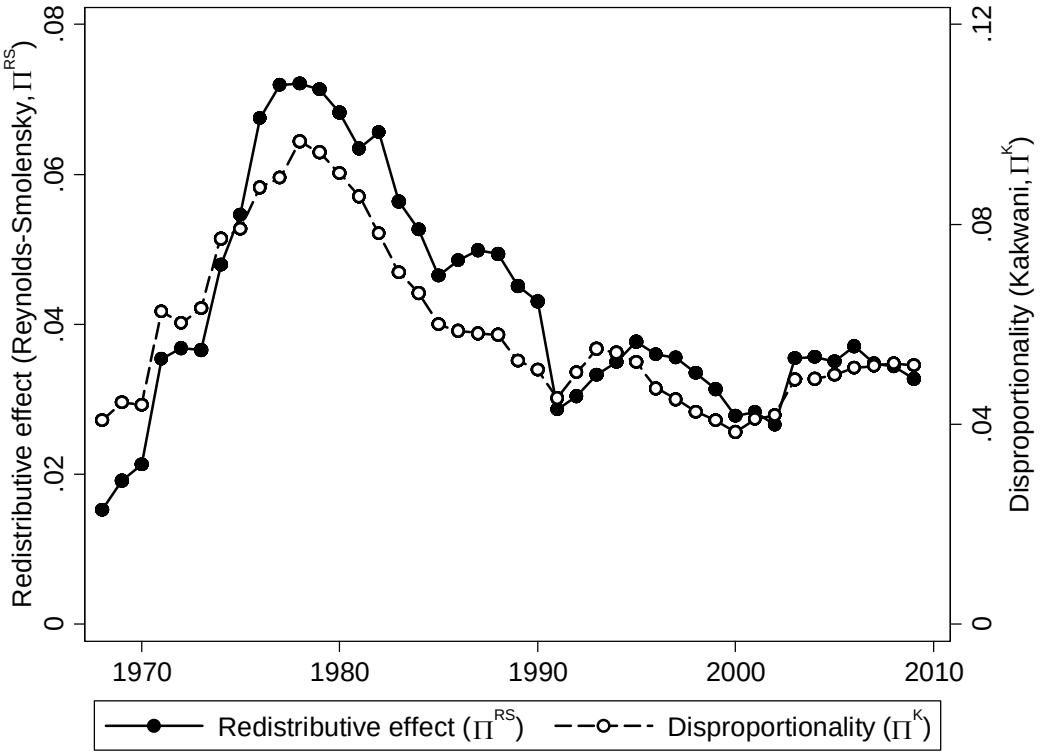

*Note*: Figures depict lifetime and annual Gini coefficients, calculated using pre-fisc incomes (pre-tax market incomes) and post-fisc incomes (disposable incomes). Annual sample: age 20–64. Lifetime sample: age 20–40 in 1968, then kept until 64. Lifetime income and taxes are discounted by 3 percent.

Figure 7: Effective tax rates in top and bottom income quintiles: Lifetime vs. annual.



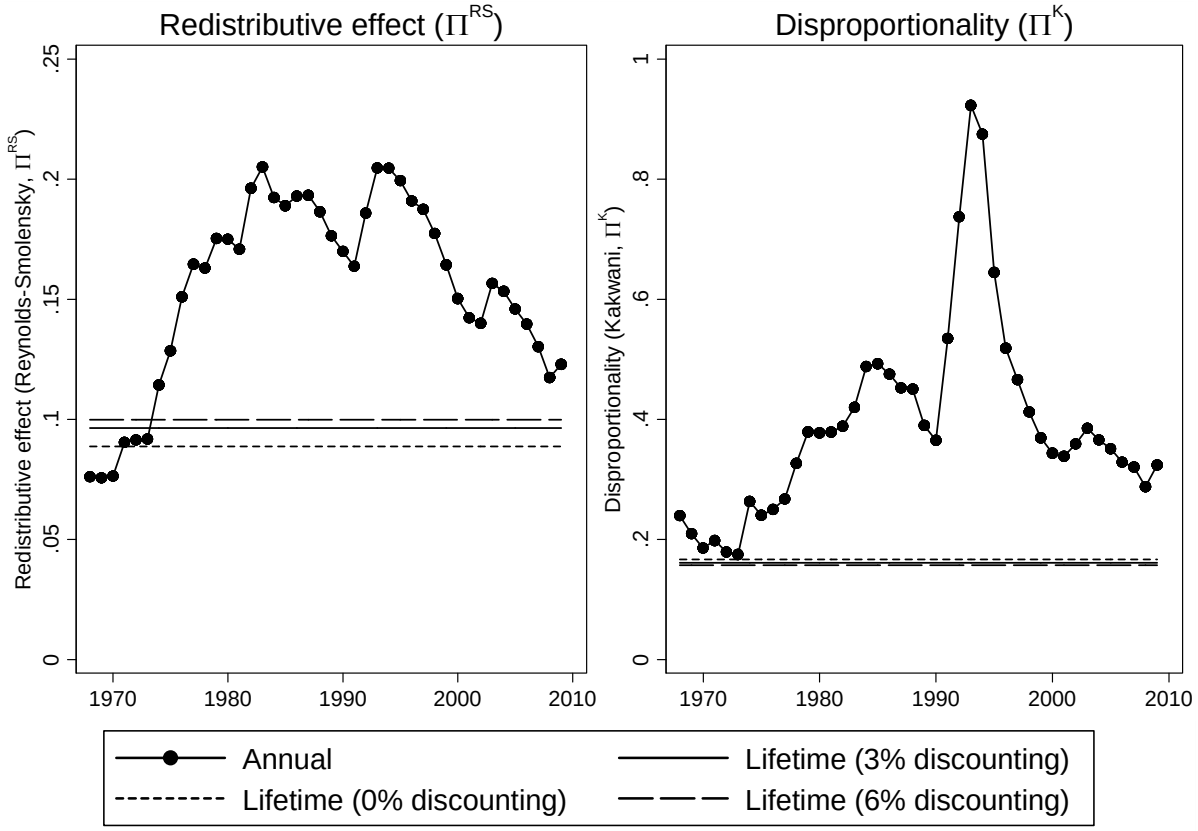

*Note*: Figures depict effective tax rates, defined as one minus the ratio between disposable income and pre-tax market income (see Appendix A.2 and the text). Individuals are ranked into top and bottom income earners based on market income. Annual sample: age 20–64. Lifetime sample: aged 20–40 in 1968, then kept until 64. Lifetime incomes and taxes are discounted by 3 percent.

Figure 8: Average tax (ATR) progressivity.



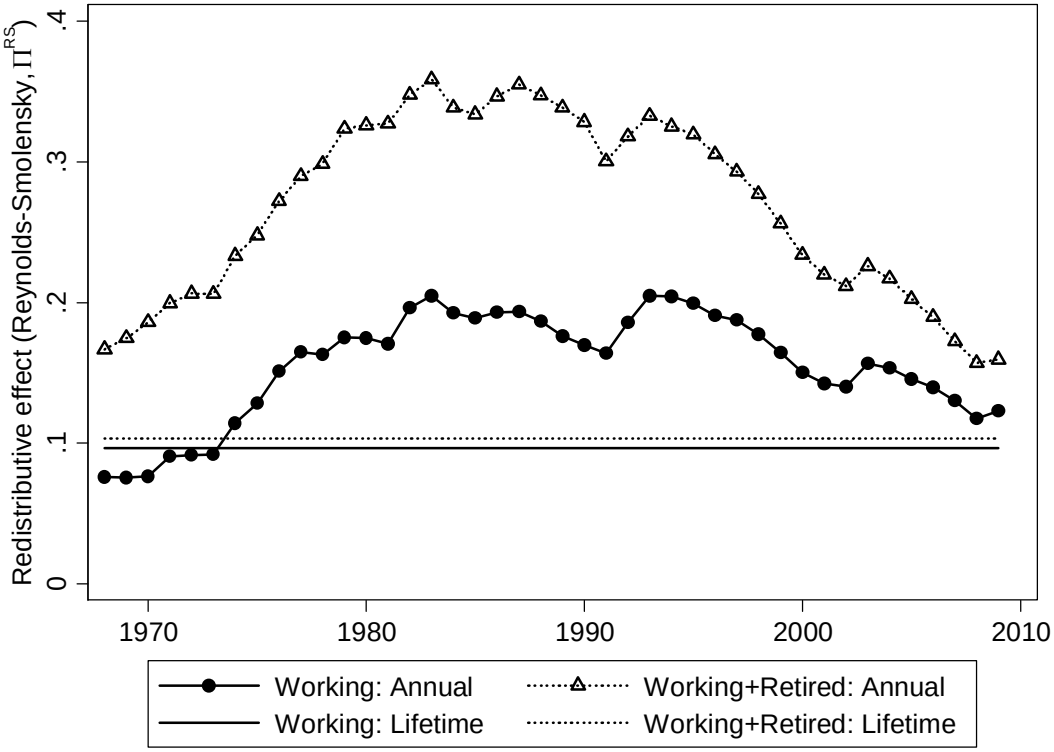

*Note*: Figures depict annual measures of average tax progressivity based on Reynolds-Smolensky and Kakwani indices. Compared to the numbers depicted in Figure 5, these numbers are calculated using pre-tax total incomes rather than pre-tax market incomes as the pre-fisc component, and pre-tax total incomes minus taxes paid rather than disposable incomes as the post-fisc component. Sample: age 20–64.

Figure 9: Different discount rates and lifetime progressivity.



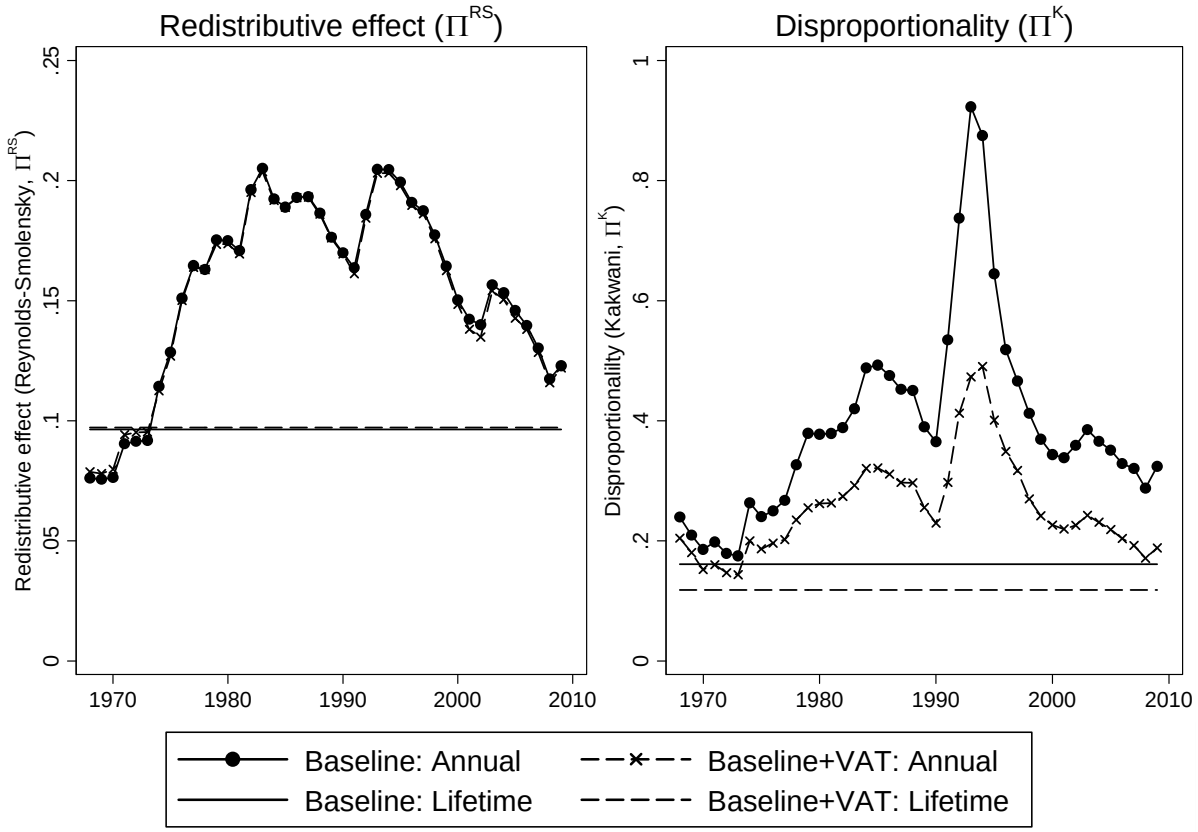

*Note*: Figures depict lifetime and annual measures of effective tax progressivity based on Reynolds-Smolensky and Kakwani indices, calculated using pre-fisc incomes (pre-tax market incomes) and post-fisc incomes (disposable incomes). Lifetime measures use different discount rates. Annual sample: age 20–64. Lifetime sample: age 20–40 in 1968, then kept until 64.

Figure 10: Including retired population when computing tax progressivity.



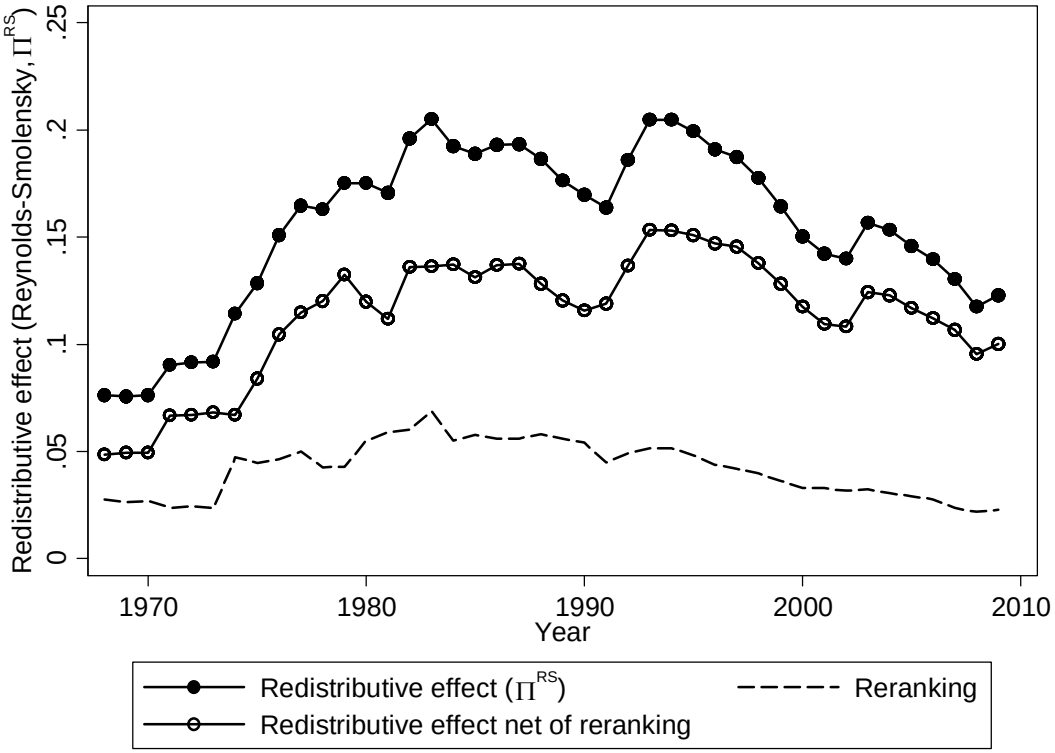

*Note*: Figure depicts lifetime and annual measures of effective tax progressivity based on Reynolds-Smolensky index. The "working+retired: annual"-sample includes all individuals in the data aged 20 and above. The "working: annual" sample includes all individuals in the data aged 20–64 (the "main" sample). The "working+retired: lifetime" is based on a cohort of individuals aged 20–40 in 1968. The "working: lifetime" data is based on individuals 20–40 in 1968, and are kept until they are 64 years. The solid lines are the same in Figure 5.

Figure 11: The role of consumption taxes (VAT) for progressivity.



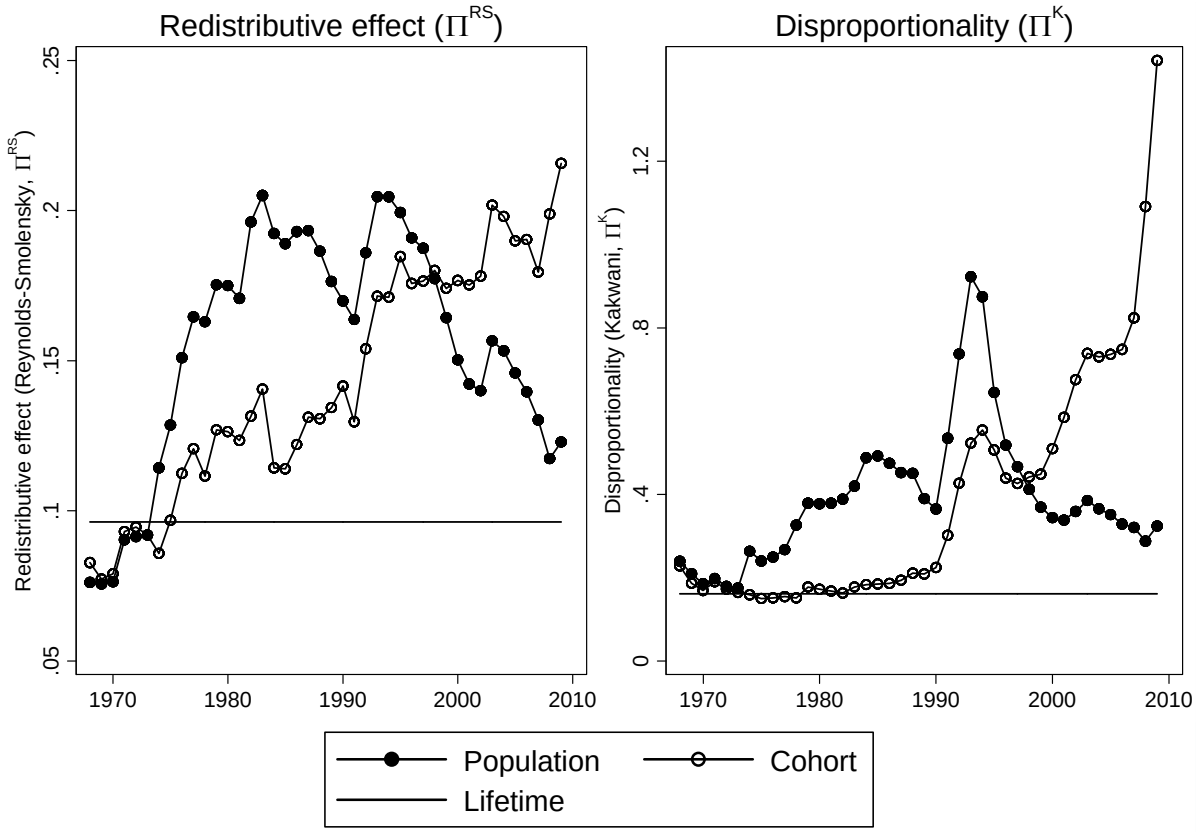

*Note*: This is a remake of Figure 9, only now disposable incomes are adjusted for value added tax.

Figure 12: Reranking and its impact on the redistributive effect.




*Note*: Figure displays annual figures of the redistributive effect (the difference between the Reynolds-Smolensky index and the Kakwani index) using effective taxes (pre-tax market incomes vs. disposable incomes). See text for further details. Sample: all individuals aged 20–64.

Figure 13: Progressivity using either population or lifetime cohort in annual cross-sections.




*Note*: Figures depict lifetime and annual measures of effective tax progressivity based on Reynolds-Smolensky index, calculated using pre-tax market incomes as pre-fisc incomes and disposable incomes as post-fisc incomes.

1. Population: sample aged 20–64.
2. Cohort: Sample aged 20–40 in 1968, then kept until 65.
   Lifetime: sample aged 20–40 in 1968, then kept until 65. Discount factor: 3 percent.

Table 1: Tax rates across tax bases: Lifetime versus annual average, (%).

| | P0–40 | P40–60 | P60–80 | P80–90 | P90–95 | P95–99 | P99–99.9 | P99.9–100 |
|---|---|---|---|---|---|---|---|---|
| *Municipal income tax* | | | | | | | | |
| Annual | 17.3 | 19.43 | 19.69 | 19.67 | 19.53 | 19.37 | 18.64 | 15.57 |
| Lifetime | 22.61 | 20.11 | 19.31 | 18.77 | 18.56 | 18.52 | 17.95 | 11.96 |
| Diff. | –5.31 | –0.68 | 0.38 | 0.9 | 0.97 | 0.85 | 0.69 | 3.61 |
| *State income tax* | | | | | | | | |
| Annual | 2.22 | 3.25 | 4.37 | 5.95 | 8.13 | 11.66 | 16.77 | 20.68 |
| Lifetime | 5.44 | 6.19 | 6.92 | 8.11 | 9.75 | 12.71 | 16.37 | 12.72 |
| Diff. | –3.22 | –2.94 | –2.55 | –2.16 | –1.62 | –1.05 | 0.4 | 7.96 |
| *Payroll tax* | | | | | | | | |
| Annual | 0.16 | 0.06 | 0.05 | 0.09 | 0.15 | 0.33 | 0.82 | 3.79 |
| Lifetime | 0.15 | 0.13 | 0.13 | 0.18 | 0.27 | 0.41 | 1.09 | 3.65 |
| Diff. | 0.01 | –0.07 | –0.08 | –0.09 | –0.12 | –0.08 | –0.27 | 0.14 |
| *Wealth and property taxes* | | | | | | | | |
| Annual | 12.97 | 18.88 | 20.83 | 21.07 | 20.86 | 20.11 | 18.22 | 11.26 |
| Lifetime | 19.28 | 20.03 | 20.36 | 20.49 | 20.38 | 20.03 | 18.33 | 10.12 |
| Diff. | –6.31 | –1.15 | 0.47 | 0.58 | 0.48 | 0.08 | –0.11 | 1.14 |

*Note*: Table displays average tax rates: annual taxes divided by pre-tax total income and lifetime taxes divided by pre-tax market income. Percentile rankings based on pre-tax total income (annual figures) and pre-tax market income (lifetime figures). Annual sample: all individuals aged 20–64. Lifetime sample: individuals aged 20–40 in 1968, then kept until 64. Lifetime discount factor: 3 percent.

Table 2: Progressivity estimates (averages) across samples and specifications

| Sample | $\Pi^{RS}$ | $\Pi^{K}$ |
|---|---|---|
| Population sample, Age 20–64, annual | 15.53 | 39.23 |
| Population sample, Age 20–64, annual, incl. VAT | 15.44 | 25.61 |
| Cohort sample, Age 20–64, annual | 14.30 | 38.75 |
| Cohort sample, Age 20–64, annual, incl. VAT | 14.27 | 24.06 |
| Cohort sample, Age 20–64, lifetime, 3 percent discounting | 9.63 | 16.11 |
| Cohort sample, Age 20–64, lifetime, 3 percent discounting, incl. VAT | 9.72 | 11.82 |
| Population sample, Age 20–, annual | 26.84 | – |
| Cohort sample, Age 20–, annual | 18.94 | – |
| Cohort sample, Age 20–, lifetime, no discounting | 10.83 | 28.56 |
| Cohort sample, Age 20–, lifetime, 3 percent discounting | 10.32 | 21.19 |
| Cohort sample, Age 20–, lifetime, 6 percent discounting | 10.14 | 17.92 |

Note: Table displays redistribution measures (Reynolds-Smolensky, RS) and disproportionality measures (Kakwani, K) across different sample specifications. "Population sample" means that the full population sample is used whereas "Cohort sample" means that the cohort of individuals aged 20–40 in 1968 is used.

## Appendix 1: Supplementary Tables

Table A1: Distribution of incomes and taxes in Sweden in 2009.

| *Panel A* | Total income | Final taxes | Municipal income tax | State income tax | Capital income tax | Real estate tax | Payroll tax | Final tax rate (ATR) |
|---|---|---|---|---|---|---|---|---|
| P0–40 | 117 | 38 | 19.74 | 0.00 | 0.44 | 0.48 | 14.83 | 32.31 |
| P40–60 | 332 | 130 | 21.47 | 0.00 | 0.23 | 0.37 | 21.57 | 39.24 |
| P60–80 | 431 | 175 | 21.91 | 0.01 | 0.29 | 0.42 | 22.37 | 40.56 |
| P80–90 | 548 | 231 | 21.85 | 0.82 | 0.60 | 0.44 | 22.23 | 42.15 |
| P90–95 | 690 | 311 | 21.43 | 3.25 | 1.21 | 0.41 | 21.86 | 45.03 |
| P95–99 | 961 | 467 | 20.68 | 6.46 | 2.39 | 0.36 | 21.00 | 48.58 |
| P99–99.9 | 1,807 | 911 | 18.10 | 9.40 | 6.00 | 0.30 | 17.91 | 50.38 |
| P99.9–100 | 7,866 | 3,237 | 10.83 | 7.62 | 12.99 | 0.15 | 9.84 | 41.14 |

| *Panel B* | Market income (Average) | Disposable income (Average) | Effective tax rate (ETR) | Market income share (%) | Disposable income share (%) |
|---|---|---|---|---|---|
| P0–40 | 72 | 109 | –51.39 | 8.82 | 19.37 |
| P40–60 | 316 | 210 | 33.54 | 19.34 | 18.65 |
| P60–80 | 424 | 266 | 37.26 | 25.95 | 23.54 |
| P80–90 | 542 | 331 | 38.93 | 16.58 | 14.67 |
| P90–95 | 684 | 397 | 41.96 | 10.46 | 8.81 |
| P95–99 | 951 | 518 | 45.53 | 11.63 | 9.18 |
| P99–99.9 | 1,772 | 924 | 47.86 | 4.88 | 3.69 |
| P99.9–100 | 7,643 | 4,714 | 38.32 | 2.34 | 2.09 |

*Note*: Incomes are in 2009 thousand SEK; tax rates are in percent. Sample: all individuals aged 20–64. Percentile rankings based on pre-tax total income (Panel A) and pre-tax market income (Panel B). The "final tax rate" equals "slutlig skatt", and is net of deductions, tax credits and fees, but includes the payroll tax.

Table A2: Average Tax Rates across income percentiles and years in Sweden

| | P0-40 | P40-60 | P60-80 | P80-90 | P90-95 | P95-99 | P99-99.9 | P99.9-100 |
|---|---|---|---|---|---|---|---|---|
| 1968 | 24.9 | 32.3 | 37.2 | 39.1 | 40.6 | 42.6 | 44.3 | 49.1 |
| 1969 | 24.6 | 34.4 | 38.9 | 40.9 | 42.3 | 44.4 | 47.4 | 44.1 |
| 1970 | 27.2 | 37.5 | 41.7 | 43.4 | 44.5 | 46.3 | 50.0 | 48.2 |
| 1971 | 24.7 | 36.4 | 41.8 | 45.2 | 47.5 | 49.2 | 53.3 | 54.0 |
| 1972 | 27.3 | 38.9 | 44.5 | 47.7 | 49.5 | 52.0 | 54.6 | 57.7 |
| 1973 | 28.6 | 39.3 | 44.3 | 47.3 | 49.8 | 52.0 | 56.3 | 68.4 |
| 1974 | 28.1 | 38.9 | 44.5 | 48.1 | 50.3 | 52.7 | 57.7 | 68.9 |
| 1975 | 29.4 | 41.0 | 46.7 | 50.1 | 52.2 | 54.7 | 59.9 | 79.8 |
| 1976 | 30.9 | 42.6 | 49.0 | 52.4 | 55.2 | 59.5 | 66.7 | 85.1 |
| 1977 | 32.2 | 43.7 | 49.8 | 53.4 | 56.0 | 60.7 | 68.3 | 82.6 |
| 1978 | 29.8 | 39.6 | 44.7 | 48.1 | 51.0 | 56.6 | 65.6 | 74.3 |
| 1979 | 30.8 | 40.1 | 44.9 | 48.2 | 51.3 | 56.4 | 65.6 | 71.6 |
| 1980 | 32.0 | 40.3 | 45.0 | 48.3 | 51.2 | 56.2 | 65.0 | 75.6 |
| 1981 | 32.4 | 40.7 | 45.3 | 48.3 | 50.8 | 55.4 | 63.2 | 70.1 |
| 1982 | 35.4 | 44.6 | 49.5 | 52.1 | 54.3 | 58.3 | 65.2 | 73.6 |
| 1983 | 35.9 | 45.0 | 49.2 | 51.0 | 52.6 | 55.5 | 62.4 | 70.6 |
| 1984 | 36.4 | 45.2 | 49.4 | 51.0 | 52.2 | 54.5 | 60.9 | 68.8 |
| 1985 | 38.2 | 45.7 | 49.3 | 50.5 | 51.8 | 54.3 | 60.7 | 72.6 |
| 1986 | 39.3 | 47.3 | 50.7 | 51.8 | 52.8 | 55.9 | 62.0 | 75.8 |
| 1987 | 40.1 | 48.1 | 51.3 | 52.3 | 53.7 | 56.7 | 62.8 | 76.0 |
| 1988 | 40.8 | 48.7 | 51.4 | 52.5 | 54.0 | 57.2 | 63.6 | 74.9 |
| 1989 | 42.0 | 49.5 | 51.7 | 52.9 | 54.5 | 57.3 | 62.9 | 75.2 |
| 1990 | 42.0 | 49.1 | 51.0 | 52.7 | 54.6 | 57.5 | 62.2 | 67.2 |
| 1991 | 36.1 | 42.8 | 44.4 | 45.5 | 46.9 | 49.1 | 50.9 | 43.6 |
| 1992 | 33.9 | 41.1 | 43.3 | 43.7 | 45.3 | 48.0 | 51.0 | 49.1 |
| 1993 | 32.4 | 39.5 | 42.2 | 42.9 | 44.7 | 47.4 | 50.1 | 49.7 |
| 1994 | 33.4 | 40.7 | 43.5 | 44.5 | 46.4 | 48.9 | 51.1 | 49.1 |
| 1995 | 35.7 | 43.6 | 46.0 | 46.8 | 48.9 | 52.0 | 55.4 | 53.0 |
| 1996 | 37.1 | 45.3 | 47.5 | 48.2 | 50.4 | 53.3 | 55.8 | 50.5 |
| 1997 | 37.9 | 46.2 | 48.3 | 49.4 | 51.6 | 54.0 | 55.4 | 47.6 |
| 1998 | 39.1 | 47.0 | 48.7 | 50.0 | 52.0 | 54.5 | 56.0 | 44.9 |
| 1999 | 38.9 | 47.2 | 48.7 | 49.9 | 51.3 | 53.2 | 53.1 | 45.7 |
| 2000 | 38.8 | 46.6 | 48.0 | 49.1 | 50.5 | 52.7 | 52.4 | 41.1 |
| 2001 | 37.8 | 45.4 | 46.3 | 47.2 | 48.5 | 50.8 | 52.9 | 48.0 |
| 2002 | 36.2 | 43.9 | 44.8 | 45.5 | 46.9 | 49.0 | 52.2 | 44.4 |
| 2003 | 36.4 | 44.0 | 45.4 | 46.5 | 48.6 | 51.7 | 54.7 | 49.5 |
| 2004 | 36.3 | 44.2 | 45.7 | 46.9 | 48.7 | 51.7 | 54.5 | 49.3 |
| 2005 | 35.5 | 43.5 | 45.1 | 46.4 | 48.4 | 51.4 | 52.7 | 46.1 |
| 2006 | 35.5 | 43.3 | 45.0 | 46.8 | 49.0 | 51.8 | 52.7 | 45.3 |
| 2007 | 34.2 | 41.2 | 42.7 | 44.8 | 47.1 | 49.9 | 50.1 | 43.7 |
| 2008 | 33.7 | 40.5 | 41.8 | 44.1 | 46.9 | 50.2 | 51.6 | 39.5 |
| 2009 | 32.3 | 39.2 | 40.6 | 42.1 | 45.0 | 48.6 | 50.4 | 41.1 |

*Note*: Ranking based on pre-tax total income. Sample: all individuals aged 20–64. Average tax rates are equal to final taxes paid (including payroll taxes and net of all exemptions and tax credits) divided by pre-tax total income. See Appendix A2.

Table A3: Effective Tax Rates across income percentiles and years in Sweden

| | P0-40 | P40-60 | P60-80 | P80-90 | P90-95 | P95-99 | P99-99.9 | P99.9-100 |
|---|---|---|---|---|---|---|---|---|
| 1968 | -70.8 | 16.9 | 31.1 | 36.2 | 40.3 | 44.1 | 46.6 | 52.2 |
| 1969 | -42.4 | 21.5 | 33.7 | 38.4 | 42.1 | 46.6 | 49.4 | 43.9 |
| 1970 | -23.9 | 26.4 | 37.0 | 41.7 | 44.9 | 48.7 | 51.7 | 51.1 |
| 1971 | -20.9 | 25.7 | 36.9 | 43.2 | 47.9 | 51.7 | 54.5 | 54.0 |
| 1972 | -13.9 | 29.0 | 40.0 | 46.0 | 49.9 | 54.0 | 57.0 | 56.7 |
| 1973 | -8.0 | 30.4 | 40.1 | 46.0 | 50.1 | 54.6 | 58.2 | 62.1 |
| 1974 | -58.0 | 28.5 | 41.2 | 47.3 | 51.7 | 55.6 | 59.1 | 66.5 |
| 1975 | -49.4 | 31.8 | 45.6 | 51.6 | 55.3 | 58.8 | 63.5 | 77.8 |
| 1976 | -52.8 | 34.2 | 49.2 | 54.7 | 57.8 | 62.1 | 69.1 | 82.8 |
| 1977 | -54.6 | 36.3 | 50.6 | 55.7 | 58.7 | 63.6 | 70.3 | 83.7 |
| 1978 | -58.4 | 35.1 | 44.3 | 49.0 | 52.7 | 58.7 | 69.1 | 78.1 |
| 1979 | -66.6 | 32.9 | 43.9 | 48.6 | 52.1 | 57.5 | 68.0 | 73.3 |
| 1980 | -65.4 | 35.1 | 46.0 | 50.9 | 54.1 | 59.0 | 68.7 | 77.3 |
| 1981 | -64.6 | 35.4 | 46.7 | 51.4 | 54.2 | 59.0 | 67.3 | 73.8 |
| 1982 | -74.7 | 38.0 | 50.2 | 54.8 | 57.7 | 61.5 | 69.3 | 79.5 |
| 1983 | -82.3 | 38.6 | 51.1 | 55.8 | 58.5 | 62.3 | 70.1 | 75.0 |
| 1984 | -91.3 | 35.1 | 46.4 | 49.4 | 51.2 | 54.1 | 61.6 | 72.7 |
| 1985 | -88.0 | 35.5 | 46.3 | 49.1 | 50.7 | 54.0 | 61.3 | 74.4 |
| 1986 | -83.7 | 36.5 | 47.1 | 49.8 | 51.6 | 55.0 | 61.8 | 77.3 |
| 1987 | -70.9 | 37.9 | 47.9 | 50.5 | 52.4 | 56.2 | 62.9 | 75.7 |
| 1988 | -65.1 | 37.6 | 47.5 | 50.0 | 52.1 | 55.6 | 61.2 | 68.7 |
| 1989 | -49.2 | 40.2 | 48.3 | 50.9 | 53.4 | 56.7 | 61.4 | 69.4 |
| 1990 | -44.3 | 40.7 | 48.0 | 51.2 | 53.8 | 57.1 | 61.7 | 65.7 |
| 1991 | -69.9 | 32.1 | 39.9 | 42.4 | 44.5 | 47.3 | 49.4 | 42.3 |
| 1992 | -118.7 | 28.8 | 39.0 | 40.8 | 42.8 | 46.0 | 49.5 | 46.9 |
| 1993 | -173.8 | 23.7 | 38.2 | 40.8 | 42.8 | 46.2 | 49.1 | 48.4 |
| 1994 | -182.6 | 24.0 | 39.0 | 41.7 | 43.5 | 46.2 | 47.1 | 45.7 |
| 1995 | -141.1 | 30.2 | 42.0 | 44.2 | 46.6 | 49.9 | 53.1 | 49.6 |
| 1996 | -123.9 | 34.2 | 43.9 | 45.8 | 48.3 | 51.3 | 53.2 | 47.1 |
| 1997 | -118.6 | 36.0 | 45.2 | 47.2 | 49.4 | 52.0 | 53.1 | 41.1 |
| 1998 | -91.4 | 37.4 | 45.8 | 47.8 | 49.9 | 52.5 | 53.5 | 40.9 |
| 1999 | -71.6 | 39.0 | 45.9 | 47.4 | 49.1 | 51.1 | 50.0 | 42.4 |
| 2000 | -56.2 | 38.6 | 44.4 | 46.2 | 47.8 | 50.1 | 48.9 | 36.7 |
| 2001 | -49.3 | 37.9 | 43.0 | 44.4 | 45.8 | 48.5 | 49.8 | 44.4 |
| 2002 | -52.9 | 36.3 | 41.6 | 42.7 | 44.1 | 46.6 | 49.2 | 41.4 |
| 2003 | -64.1 | 36.7 | 42.3 | 43.9 | 46.2 | 49.3 | 52.0 | 45.8 |
| 2004 | -64.0 | 37.4 | 42.5 | 43.8 | 45.8 | 49.0 | 51.7 | 46.9 |
| 2005 | -61.0 | 36.9 | 41.9 | 43.3 | 45.5 | 48.5 | 48.1 | 42.9 |
| 2006 | -50.9 | 36.1 | 41.2 | 43.3 | 45.7 | 48.8 | 49.7 | 43.5 |
| 2007 | -43.0 | 35.6 | 39.3 | 41.3 | 43.5 | 46.5 | 46.8 | 41.2 |
| 2008 | -34.6 | 35.2 | 38.3 | 40.4 | 43.2 | 46.7 | 47.6 | 36.7 |
| 2009 | -51.4 | 33.5 | 37.4 | 39.0 | 41.9 | 45.6 | 47.8 | 38.3 |

*Note*: Ranking based on pre-tax market income. Effective tax rates are equal to one minus the ratio between disposable income and market income. Sample: all individuals aged 20–64. See Appendix A2 for details.

Table A4: Market income shares across income percentiles and years. Sweden.

| | P0-40 | P40-60 | P60-80 | P80-90 | P90-95 | P95-99 | P99-99.9 | P99.9-100 |
|---|---|---|---|---|---|---|---|---|
| 1968 | 3.64 | 16.12 | 27.77 | 18.74 | 12.19 | 14.25 | 5.85 | 1.44 |
| 1969 | 4.85 | 16.26 | 27.32 | 18.42 | 11.87 | 13.82 | 5.74 | 1.72 |
| 1970 | 6.21 | 16.70 | 27.25 | 18.14 | 11.57 | 13.24 | 5.44 | 1.46 |
| 1971 | 6.79 | 16.84 | 27.31 | 18.10 | 11.40 | 12.84 | 5.26 | 1.46 |
| 1972 | 7.20 | 17.42 | 27.27 | 17.85 | 11.20 | 12.62 | 5.06 | 1.39 |
| 1973 | 7.94 | 17.74 | 27.03 | 17.47 | 10.95 | 12.26 | 4.95 | 1.66 |
| 1974 | 6.37 | 17.82 | 27.60 | 17.81 | 11.12 | 12.41 | 5.03 | 1.84 |
| 1975 | 6.73 | 17.90 | 27.87 | 18.06 | 11.17 | 11.89 | 4.63 | 1.75 |
| 1976 | 7.08 | 17.99 | 28.28 | 17.98 | 10.82 | 11.63 | 4.55 | 1.67 |
| 1977 | 7.70 | 18.27 | 28.38 | 17.77 | 10.60 | 11.26 | 4.40 | 1.63 |
| 1978 | 8.52 | 19.49 | 27.79 | 17.13 | 10.20 | 10.97 | 4.33 | 1.57 |
| 1979 | 8.90 | 19.35 | 27.95 | 17.06 | 10.10 | 10.82 | 4.22 | 1.60 |
| 1980 | 9.30 | 19.71 | 27.97 | 17.11 | 10.00 | 10.46 | 3.99 | 1.46 |
| 1981 | 9.50 | 19.80 | 28.22 | 17.22 | 10.09 | 10.30 | 3.85 | 1.03 |
| 1982 | 9.43 | 19.84 | 28.41 | 17.26 | 10.03 | 10.21 | 3.77 | 1.05 |
| 1983 | 9.59 | 19.85 | 28.42 | 17.23 | 10.03 | 10.11 | 3.71 | 1.06 |
| 1984 | 9.53 | 19.90 | 28.44 | 17.28 | 10.06 | 10.19 | 3.66 | 0.93 |
| 1985 | 9.87 | 19.97 | 28.17 | 17.28 | 10.09 | 10.24 | 3.54 | 0.84 |
| 1986 | 10.03 | 20.06 | 28.05 | 17.13 | 10.05 | 10.17 | 3.48 | 1.02 |
| 1987 | 10.86 | 20.10 | 27.54 | 16.89 | 9.94 | 10.12 | 3.49 | 1.06 |
| 1988 | 11.36 | 20.00 | 27.15 | 16.72 | 9.90 | 10.09 | 3.54 | 1.24 |
| 1989 | 12.10 | 20.09 | 26.90 | 16.58 | 9.82 | 10.01 | 3.45 | 1.05 |
| 1990 | 12.10 | 19.99 | 26.80 | 16.66 | 9.93 | 10.11 | 3.46 | 0.95 |
| 1991 | 11.27 | 19.73 | 26.54 | 16.62 | 10.08 | 10.59 | 3.82 | 1.34 |
| 1992 | 9.33 | 20.04 | 27.57 | 17.14 | 10.30 | 10.79 | 3.79 | 1.05 |
| 1993 | 7.59 | 19.37 | 28.19 | 17.67 | 10.67 | 11.20 | 4.03 | 1.28 |
| 1994 | 7.11 | 18.98 | 27.96 | 17.66 | 10.72 | 11.50 | 4.41 | 1.67 |
| 1995 | 7.79 | 19.43 | 27.84 | 17.56 | 10.63 | 11.24 | 4.11 | 1.41 |
| 1996 | 7.69 | 19.63 | 27.78 | 17.39 | 10.59 | 11.35 | 4.14 | 1.42 |
| 1997 | 7.50 | 19.44 | 27.62 | 17.32 | 10.59 | 11.46 | 4.30 | 1.77 |
| 1998 | 8.33 | 19.35 | 26.98 | 16.94 | 10.43 | 11.30 | 4.29 | 2.39 |
| 1999 | 9.08 | 19.35 | 26.40 | 16.65 | 10.40 | 11.46 | 4.67 | 2.00 |
| 2000 | 9.76 | 18.94 | 25.52 | 16.20 | 10.18 | 11.38 | 4.97 | 3.04 |
| 2001 | 10.24 | 19.15 | 25.66 | 16.38 | 10.32 | 11.42 | 4.68 | 2.15 |
| 2002 | 10.12 | 19.15 | 25.77 | 16.49 | 10.36 | 11.44 | 4.44 | 2.23 |
| 2003 | 9.64 | 19.49 | 26.31 | 16.67 | 10.40 | 11.39 | 4.47 | 1.64 |
| 2004 | 9.29 | 19.32 | 26.24 | 16.70 | 10.45 | 11.51 | 4.67 | 1.82 |
| 2005 | 9.14 | 19.08 | 25.94 | 16.62 | 10.48 | 11.72 | 4.92 | 2.10 |
| 2006 | 9.44 | 18.90 | 25.56 | 16.38 | 10.35 | 11.65 | 5.13 | 2.59 |
| 2007 | 10.02 | 18.84 | 25.18 | 16.17 | 10.32 | 11.73 | 5.29 | 2.46 |
| 2008 | 10.01 | 19.09 | 25.23 | 16.07 | 10.15 | 11.36 | 4.90 | 3.18 |
| 2009 | 8.82 | 19.34 | 25.95 | 16.58 | 10.46 | 11.63 | 4.88 | 2.34 |

*Note*: Ranking based on market income. Sample: all individuals aged 20–64.

Table A5: Disposable income shares across income percentile and year.

| | P0-40 | P40-60 | P60-80 | P80-90 | P90-95 | P95-99 | P99-99.9 | P99.9-100 |
|---|---|---|---|---|---|---|---|---|
| 1968 | 8.91 | 19.21 | 27.43 | 17.13 | 10.43 | 11.43 | 4.48 | 0.99 |
| 1969 | 10.26 | 18.96 | 26.95 | 16.88 | 10.22 | 10.98 | 4.31 | 1.44 |
| 1970 | 11.97 | 19.14 | 26.73 | 16.47 | 9.92 | 10.58 | 4.08 | 1.11 |
| 1971 | 12.94 | 19.73 | 27.17 | 16.20 | 9.36 | 9.77 | 3.77 | 1.06 |
| 1972 | 13.50 | 20.34 | 26.94 | 15.85 | 9.24 | 9.56 | 3.58 | 0.99 |
| 1973 | 14.22 | 20.49 | 26.84 | 15.66 | 9.08 | 9.24 | 3.43 | 1.04 |
| 1974 | 16.23 | 20.57 | 26.20 | 15.14 | 8.66 | 8.90 | 3.32 | 0.99 |
| 1975 | 17.29 | 21.01 | 26.08 | 15.03 | 8.59 | 8.43 | 2.91 | 0.67 |
| 1976 | 19.37 | 21.20 | 25.73 | 14.60 | 8.18 | 7.89 | 2.52 | 0.51 |
| 1977 | 21.46 | 20.99 | 25.25 | 14.18 | 7.89 | 7.39 | 2.36 | 0.48 |
| 1978 | 21.98 | 20.60 | 25.20 | 14.22 | 7.87 | 7.38 | 2.18 | 0.56 |
| 1979 | 23.36 | 20.47 | 24.70 | 13.81 | 7.62 | 7.24 | 2.12 | 0.67 |
| 1980 | 24.76 | 20.58 | 24.30 | 13.53 | 7.39 | 6.90 | 2.01 | 0.53 |
| 1981 | 25.13 | 20.56 | 24.18 | 13.46 | 7.43 | 6.78 | 2.02 | 0.43 |
| 1982 | 27.33 | 20.42 | 23.46 | 12.95 | 7.04 | 6.52 | 1.92 | 0.36 |
| 1983 | 28.89 | 20.15 | 22.94 | 12.57 | 6.87 | 6.30 | 1.83 | 0.44 |
| 1984 | 27.46 | 19.45 | 22.97 | 13.18 | 7.40 | 7.04 | 2.12 | 0.38 |
| 1985 | 27.86 | 19.32 | 22.70 | 13.22 | 7.47 | 7.06 | 2.05 | 0.32 |
| 1986 | 28.09 | 19.42 | 22.61 | 13.12 | 7.41 | 6.97 | 2.03 | 0.35 |
| 1987 | 28.79 | 19.37 | 22.26 | 12.97 | 7.34 | 6.87 | 2.01 | 0.40 |
| 1988 | 28.93 | 19.25 | 21.98 | 12.89 | 7.32 | 6.91 | 2.12 | 0.60 |
| 1989 | 28.81 | 19.17 | 22.19 | 12.98 | 7.31 | 6.91 | 2.12 | 0.51 |
| 1990 | 28.19 | 19.13 | 22.48 | 13.13 | 7.41 | 7.00 | 2.14 | 0.53 |
| 1991 | 26.61 | 18.62 | 22.16 | 13.31 | 7.78 | 7.76 | 2.69 | 1.08 |
| 1992 | 26.91 | 18.82 | 22.18 | 13.38 | 7.78 | 7.68 | 2.52 | 0.73 |
| 1993 | 26.53 | 18.89 | 22.26 | 13.36 | 7.79 | 7.70 | 2.62 | 0.84 |
| 1994 | 25.97 | 18.66 | 22.05 | 13.31 | 7.83 | 8.00 | 3.01 | 1.17 |
| 1995 | 26.00 | 18.78 | 22.35 | 13.56 | 7.86 | 7.80 | 2.66 | 0.98 |
| 1996 | 25.01 | 18.75 | 22.65 | 13.68 | 7.96 | 8.04 | 2.82 | 1.09 |
| 1997 | 24.46 | 18.55 | 22.58 | 13.65 | 8.00 | 8.20 | 3.00 | 1.55 |
| 1998 | 24.34 | 18.48 | 22.32 | 13.50 | 7.98 | 8.19 | 3.04 | 2.15 |
| 1999 | 24.04 | 18.22 | 22.05 | 13.51 | 8.16 | 8.64 | 3.60 | 1.77 |
| 2000 | 23.36 | 17.82 | 21.74 | 13.36 | 8.15 | 8.72 | 3.90 | 2.95 |
| 2001 | 23.20 | 18.03 | 22.17 | 13.81 | 8.48 | 8.93 | 3.56 | 1.81 |
| 2002 | 22.89 | 18.02 | 22.27 | 13.96 | 8.57 | 9.02 | 3.33 | 1.93 |
| 2003 | 23.58 | 18.40 | 22.61 | 13.94 | 8.34 | 8.61 | 3.19 | 1.32 |
| 2004 | 22.89 | 18.17 | 22.66 | 14.10 | 8.51 | 8.82 | 3.40 | 1.45 |
| 2005 | 22.07 | 18.04 | 22.57 | 14.11 | 8.55 | 9.04 | 3.82 | 1.80 |
| 2006 | 21.50 | 18.23 | 22.67 | 14.01 | 8.48 | 9.00 | 3.89 | 2.21 |
| 2007 | 21.19 | 17.96 | 22.60 | 14.05 | 8.62 | 9.28 | 4.16 | 2.14 |
| 2008 | 20.00 | 18.37 | 23.09 | 14.21 | 8.55 | 8.98 | 3.81 | 2.99 |
| 2009 | 19.37 | 18.65 | 23.54 | 14.67 | 8.81 | 9.18 | 3.69 | 2.09 |

*Note*: Ranking based on market income. Sample: all individuals aged 20–64.

Table A6: Relative Share Adjustment: Ratio between disposable and market income shares.

| | P0-40 | P40-60 | P60-80 | P80-90 | P90-95 | P95-99 | P99-99.9 | P99.9-100 |
|---|---|---|---|---|---|---|---|---|
| 1968 | 2.449 | 1.191 | 0.988 | 0.914 | 0.856 | 0.802 | 0.765 | 0.686 |
| 1969 | 2.117 | 1.167 | 0.986 | 0.916 | 0.861 | 0.795 | 0.752 | 0.833 |
| 1970 | 1.929 | 1.146 | 0.981 | 0.908 | 0.857 | 0.799 | 0.751 | 0.761 |
| 1971 | 1.905 | 1.171 | 0.995 | 0.895 | 0.821 | 0.761 | 0.717 | 0.725 |
| 1972 | 1.875 | 1.168 | 0.988 | 0.888 | 0.825 | 0.758 | 0.707 | 0.712 |
| 1973 | 1.791 | 1.155 | 0.993 | 0.896 | 0.829 | 0.753 | 0.693 | 0.629 |
| 1974 | 2.548 | 1.154 | 0.949 | 0.850 | 0.779 | 0.717 | 0.659 | 0.540 |
| 1975 | 2.571 | 1.174 | 0.936 | 0.832 | 0.768 | 0.709 | 0.628 | 0.382 |
| 1976 | 2.736 | 1.179 | 0.910 | 0.812 | 0.757 | 0.678 | 0.554 | 0.308 |
| 1977 | 2.787 | 1.149 | 0.890 | 0.798 | 0.744 | 0.657 | 0.536 | 0.294 |
| 1978 | 2.581 | 1.057 | 0.907 | 0.830 | 0.771 | 0.673 | 0.503 | 0.356 |
| 1979 | 2.625 | 1.057 | 0.884 | 0.810 | 0.754 | 0.669 | 0.503 | 0.421 |
| 1980 | 2.661 | 1.044 | 0.869 | 0.791 | 0.739 | 0.660 | 0.504 | 0.365 |
| 1981 | 2.645 | 1.038 | 0.857 | 0.781 | 0.737 | 0.659 | 0.526 | 0.422 |
| 1982 | 2.899 | 1.029 | 0.826 | 0.750 | 0.702 | 0.639 | 0.509 | 0.340 |
| 1983 | 3.012 | 1.015 | 0.807 | 0.730 | 0.685 | 0.623 | 0.495 | 0.414 |
| 1984 | 2.882 | 0.977 | 0.808 | 0.762 | 0.735 | 0.691 | 0.579 | 0.411 |
| 1985 | 2.822 | 0.967 | 0.806 | 0.765 | 0.740 | 0.690 | 0.580 | 0.384 |
| 1986 | 2.799 | 0.968 | 0.806 | 0.766 | 0.738 | 0.685 | 0.583 | 0.346 |
| 1987 | 2.651 | 0.964 | 0.808 | 0.768 | 0.738 | 0.679 | 0.576 | 0.377 |
| 1988 | 2.547 | 0.962 | 0.810 | 0.771 | 0.740 | 0.685 | 0.599 | 0.483 |
| 1989 | 2.381 | 0.955 | 0.825 | 0.783 | 0.744 | 0.690 | 0.615 | 0.488 |
| 1990 | 2.330 | 0.957 | 0.839 | 0.788 | 0.746 | 0.693 | 0.618 | 0.553 |
| 1991 | 2.362 | 0.944 | 0.835 | 0.801 | 0.771 | 0.732 | 0.704 | 0.802 |
| 1992 | 2.884 | 0.939 | 0.805 | 0.781 | 0.755 | 0.712 | 0.666 | 0.700 |
| 1993 | 3.498 | 0.975 | 0.790 | 0.756 | 0.730 | 0.687 | 0.650 | 0.660 |
| 1994 | 3.653 | 0.983 | 0.789 | 0.754 | 0.730 | 0.696 | 0.684 | 0.701 |
| 1995 | 3.338 | 0.967 | 0.803 | 0.772 | 0.740 | 0.694 | 0.649 | 0.698 |
| 1996 | 3.253 | 0.955 | 0.816 | 0.787 | 0.751 | 0.708 | 0.679 | 0.768 |
| 1997 | 3.262 | 0.954 | 0.818 | 0.788 | 0.755 | 0.716 | 0.699 | 0.879 |
| 1998 | 2.922 | 0.955 | 0.827 | 0.797 | 0.765 | 0.724 | 0.710 | 0.902 |
| 1999 | 2.648 | 0.942 | 0.835 | 0.811 | 0.785 | 0.754 | 0.772 | 0.889 |
| 2000 | 2.394 | 0.941 | 0.852 | 0.825 | 0.800 | 0.766 | 0.783 | 0.970 |
| 2001 | 2.265 | 0.941 | 0.864 | 0.843 | 0.822 | 0.782 | 0.761 | 0.844 |
| 2002 | 2.261 | 0.941 | 0.864 | 0.847 | 0.827 | 0.789 | 0.752 | 0.867 |
| 2003 | 2.446 | 0.944 | 0.859 | 0.836 | 0.802 | 0.756 | 0.715 | 0.808 |
| 2004 | 2.465 | 0.940 | 0.863 | 0.844 | 0.815 | 0.766 | 0.727 | 0.798 |
| 2005 | 2.413 | 0.946 | 0.870 | 0.849 | 0.816 | 0.772 | 0.777 | 0.856 |
| 2006 | 2.277 | 0.965 | 0.887 | 0.855 | 0.820 | 0.772 | 0.759 | 0.853 |
| 2007 | 2.115 | 0.953 | 0.898 | 0.869 | 0.835 | 0.791 | 0.786 | 0.870 |
| 2008 | 1.998 | 0.962 | 0.915 | 0.884 | 0.843 | 0.791 | 0.777 | 0.939 |
| 2009 | 2.196 | 0.964 | 0.907 | 0.885 | 0.842 | 0.789 | 0.756 | 0.894 |

*Note*: The table displays ratios between cells in Tables 6 and 5. A ratio above one means that the income group is favored by the tax system; a ratio below one means that the income group is disfavored. See Baum (1987, 1998).

Table A7: Gini coefficients and progressivity measures.

| | Market income Gini | Disposable income Gini | Kakwani index ($\Pi^K$) | Reranking effect ($R$) | Reynolds-Smolensky index ($\Pi^{RS}$) |
|---|---|---|---|---|---|
| 1968 | 0.551 | 0.475 | 0.239 | 0.028 | 0.076 |
| 1969 | 0.537 | 0.461 | 0.209 | 0.026 | 0.076 |
| 1970 | 0.514 | 0.438 | 0.185 | 0.027 | 0.076 |
| 1971 | 0.504 | 0.414 | 0.198 | 0.024 | 0.090 |
| 1972 | 0.494 | 0.403 | 0.179 | 0.024 | 0.091 |
| 1973 | 0.483 | 0.391 | 0.175 | 0.024 | 0.092 |
| 1974 | 0.500 | 0.386 | 0.263 | 0.047 | 0.114 |
| 1975 | 0.492 | 0.363 | 0.240 | 0.045 | 0.129 |
| 1976 | 0.484 | 0.333 | 0.250 | 0.046 | 0.151 |
| 1977 | 0.473 | 0.308 | 0.267 | 0.050 | 0.165 |
| 1978 | 0.455 | 0.292 | 0.327 | 0.043 | 0.163 |
| 1979 | 0.450 | 0.275 | 0.379 | 0.043 | 0.175 |
| 1980 | 0.441 | 0.266 | 0.378 | 0.055 | 0.175 |
| 1981 | 0.435 | 0.264 | 0.379 | 0.059 | 0.171 |
| 1982 | 0.435 | 0.239 | 0.389 | 0.060 | 0.196 |
| 1983 | 0.432 | 0.227 | 0.420 | 0.069 | 0.205 |
| 1984 | 0.433 | 0.240 | 0.488 | 0.055 | 0.192 |
| 1985 | 0.428 | 0.239 | 0.493 | 0.058 | 0.189 |
| 1986 | 0.426 | 0.233 | 0.475 | 0.056 | 0.193 |
| 1987 | 0.417 | 0.224 | 0.452 | 0.056 | 0.193 |
| 1988 | 0.413 | 0.227 | 0.450 | 0.058 | 0.186 |
| 1989 | 0.403 | 0.227 | 0.390 | 0.056 | 0.176 |
| 1990 | 0.404 | 0.234 | 0.365 | 0.054 | 0.170 |
| 1991 | 0.420 | 0.257 | 0.535 | 0.045 | 0.164 |
| 1992 | 0.439 | 0.253 | 0.737 | 0.049 | 0.186 |
| 1993 | 0.465 | 0.260 | 0.923 | 0.051 | 0.205 |
| 1994 | 0.477 | 0.272 | 0.875 | 0.052 | 0.205 |
| 1995 | 0.464 | 0.264 | 0.645 | 0.048 | 0.199 |
| 1996 | 0.464 | 0.273 | 0.518 | 0.044 | 0.191 |
| 1997 | 0.470 | 0.282 | 0.466 | 0.042 | 0.187 |
| 1998 | 0.464 | 0.286 | 0.412 | 0.040 | 0.177 |
| 1999 | 0.457 | 0.292 | 0.369 | 0.036 | 0.164 |
| 2000 | 0.457 | 0.307 | 0.344 | 0.033 | 0.150 |
| 2001 | 0.447 | 0.304 | 0.339 | 0.033 | 0.142 |
| 2002 | 0.448 | 0.308 | 0.359 | 0.032 | 0.140 |
| 2003 | 0.448 | 0.291 | 0.385 | 0.032 | 0.157 |
| 2004 | 0.455 | 0.302 | 0.366 | 0.031 | 0.153 |
| 2005 | 0.461 | 0.315 | 0.351 | 0.029 | 0.146 |
| 2006 | 0.462 | 0.322 | 0.329 | 0.028 | 0.140 |
| 2007 | 0.457 | 0.327 | 0.321 | 0.024 | 0.130 |
| 2008 | 0.455 | 0.338 | 0.288 | 0.022 | 0.117 |
| 2009 | 0.464 | 0.341 | 0.324 | 0.023 | 0.123 |

*Note*: The table displays progressivity measures based on pre-tax market income versus disposable incomes.

## Appendix 2: Descriptions of data sources and some specific variables

The data consist of a random selection of 3.35% of the Swedish population. The selections are annual, and range from 180,000 (1968) to 300,000 (2009) observations per year, meaning that each year of data consists of a representative sample. Between 1981 and 1986, the three richest individuals (in terms of taxable income) were dropped due to inconsistent tax records. A small number of duplicate observations in the early period (1968–1974) were dropped (in the early period, individuals were drawn with replacement, meaning that the same individual could appear twice in the registers). The full computer code used to construct the dataset will be available on our websites.

Pre-tax total income

Pre-tax total income is defined as earnings from employment and self-employment (including the imputed payroll tax), taxable social transfers, and capital income, including realized capital gains, and the imputed value of owner-occupied housing.

Market income

Market income is the sum of pre-tax labor income (not including social insurance but including payroll taxes; see below), capital income, capital income gains, and the imputed value of owner-occupied housing. The main difference between market income and pre-tax total income is that taxable social security transfers (pensions, sickness insurance, unemployment insurance etc.) are omitted from market income.

Labor income

Labor income (or earnings) is used primarily to impute payroll taxes. Labor income includes income from self-employment, wage earnings and other income sources if payroll taxes are levied on them. It therefore includes sick pay ("sjuklön") and holiday compensation, but not sickness insurance ("sjukersättning"), unemployment insurance and other social transfers paid by the National Insurance Board. It does not include pensions.

Social insurance and social benefits (sickness insurance, unemployment compensation, etc.) are excluded from our definition of labor income, and this is the main difference from conventional definitions of earnings. Note that although the National Insurance Board (Försäkringskassan) does pay a pension contribution for all social insurance payments, this fee is filed as a special pension fee ("särskild pensionsavgift") and not part of the payroll tax. It is thus more apt to regard social insurance payments as non-market incomes, in particular when calculating payroll tax liability. However, payroll taxes *are* levied on employer-paid benefits (sick pay, holiday compensation, etc.), which we therefore include in our definition of labor income.

The rule that labor income is subject to payroll taxes or social fees has

some additional exceptions. Non-taxable employer-paid benefits associated with employee expenses (per-diem, travel compensation, etc.) are exempt from payroll taxes, as is income from passive self-employment ("inkomst från passiv näringsverksamhet"), for which the social fee is replaced by a special income tax ("särskild löneskatt på vissa förvärvsinkomster"). Work compensation in the form of dividends from shares in small public companies ("inkomst från fåmansbolag") is filed as wage income for the recipient, but is exempt from employer-paid payroll taxes because the transfer has already been subject to corporate income taxation. Therefore, we do not include these income sources in our definition of labor income.

Social fees are, however, levied on a special type of temporary activities which is not typically regarded as wage income. These activities include hobbies, temporary work abroad or work for a foreign employer, as well as one-shot payments for patents, etc. Since these hobby-related income sources are subject to payroll taxation, we include them in labor income.

Capital income, and capital gains

Capital income is defined as the sum of interest rates and dividends. Capital income gains are realized capital income from stocks, property, etc. Capital income is never negative (thus, we do not subtract losses from total income).

Imputed income from owner-occupied housing

Imputed income from owner-occupied housing was up until 1990 calculated by Swedish tax authorities as a specific source ("inkomst av av annan fastighet") and included in gross total income. From 1991 onwards, however, this source has been dropped from the official income concepts by Swedish tax and statistics authorities. To restore consistency and comparability over time, we impute it using tax-assessed property values which are reported for each individual in the official income tax records.

We adjust tax-assessed values to market values using purchasing price adjustment quotas ("köpeskillingskoefficienter") defined as the ratio between the market value of the property and the assessed value reported annually for each municipality by Statistics Sweden. This computed market-valued property is then multiplied by 0.04, reflecting the annual real rate of return on the capital stock. This flow, in turn, is what we use as imputed value of owner-occupied housing.

Disposable income

Disposable income is calculated by Statistic Sweden since 1978. We use the numbers at the individual (and not household) level in order to retain the consistency of income earning units in our lifetime analysis. Disposable income includes market income net of taxes plus transfers (including social insurance net of taxes). For the period 1968-1978, we calculated disposable incomes using total pre-tax income plus imputed social fees, state retirement pensions and child allowances (see below).

Payroll taxes

Payroll taxes are not reported on individual tax records or in Swedish administrative registers. They were therefore imputed by us using the following formula:

$$Payroll\ tax = ptax_{ti} \times Labor\ income,$$

were $ptax_{ti}$is the payroll tax for year $t$ for individual $i$. The payroll tax is typically the same for all individuals. The employer-paid payroll tax ("arbetsgivaravgifter") is not always equal to the social fees paid by self-employers ("egenavgiften"), as assumed by our imputations, but the differences are typically negligible.

Social fees 1968–1973, state retirement pensions 1968–1977, child allowance 1968–1977.

Sickness insurance and unemployment benefits were not taxable and therefore not observable in our data until 1974. For the years 1968–1973, we therefore impute these social transfers using an algorithm based on information about age, gender and market income and the relationship between these variables and social transfers in 1974.

Elderly individuals with no income need not report state retirement pensions ("folkpension"). In this case, given the universality of the system, it is however safe to assume that most elderly received retirement pensions. State retirement pensions were therefore calculated for individuals older than 66 years with zero income using the statutory rates (which varied depending on household size). Note that this imputation is inessential for the results that use only the working population (20–64 years of age).

Non-taxed transfers are not reported in the Swedish register databases until 1978. The most important of these transfers is child allowances. Again, due to the universal coverage of child allowances in Sweden and the fact that our data is based on the same administrative records that was used for the distribution of the allowances, it is straightforward to back out the child allowances using the statutory rates per child, times the number of children residing in the household.

VAT

Value-added tax payments, used in some auxiliary tables and figures, are imputed by adjusting the annual VAT rate by the household savings ratio and then by multiplying this figure with disposable income. This procedure means that it is proportional to disposable income (but regressive relative pre-tax market income at the annual level as individuals with low market income tend to have higher relative disposable incomes).

Wealth tax

The wealth tax was levied on households, but in tax registers it is also reported for individuals almost all years up to its abolishment 2007. Only for the earliest period 1968–1971, it was not reported separately and we therefore calculate it using the statutory rates and information about taxable wealth at the individual level.

Table A8: Income definitions using LINDA variable names (constructed variables in bold).

| Labor income (**linc**) | |
|---|---|
| 1968–1971 | intj+inro+**ptax** if alder<=67 |
| | ainro+**ptax** if alder>67 |
| 1971–1973 | aintj+bintj+ainro+**ptax** if alder<=67 |
| | ainro+**ptax** if alder>67 |
| 1974–1977 | max(aintj+bintj+ainro–(kbin–spkbin)–pens,0)+**ptax** |
| 1978–1979 | max(arbink–sjukpan,0)+**ptax** |
| 1980–1983 | max(arbinsj–insjo–sjukpan,0)+**ptax** |
| 1984–1992 | linc=max(arbink–insjo–sjukpan,0)+**ptax** |
| 1993 | max(tlont+nakt+thobby–tsjo,0)+**ptax** |
| 1994–1995 | max(tlont+thobby+nakt–tsjo–tfoab,0)+**ptax** |
| 1996 | max(tlont+thobby+nakt–tsjo–tfoab,0)+**ptax** |
| 1997 | max(tlont+thobby+nakte+nakthb–tsjo,0)+**ptax** |
| 1998–2009 | tlont+thobby+nakte+nakthb+**ptax** |

*Note*: The retirement age was 67 years up to July 1975, when it was lowered to 65 years.

| Capital income, including capital income gains (**cinc**) | |
|---|---|
| 1968–1977 | inka+intf |
| 1978–1990 | instff+inkap |
| 1991–1992 | max(inkap,0) |
| 1993–2009 | max(kkap,0) |

| Capital income gains (**cincg**) | |
|---|---|
| 1968–1977 | intf |
| 1978–1990 | Instff |
| 1991–1992 | max(kapreav–kapreaf,0) |
| 1993–2009 | max(kv–kf,0) |

| Capital income | |
|---|---|
| 1968–2009 | **cinc–cincg** |

| Imputed income from owner–occupied housing (**einc**) | |
|---|---|
| 1968–1971 | injo+inaf |
| 1971–1977 | inaf+ainjo+binjo |
| 1978–1984 | insfast+inasjor+inbsjor |
| 1985–1990 | ufast***kopcof***0.04 |
| 1991 | (ufasts1+ufasts2+ufasts3)***kopcof***0.04 |
| 1992 | (ufasts1+ufasts2+ufasts3+ufasts4)***kopcof***0.04 |
| 1993–1995 | (asma15+asma075+asma0)***kopcof***0.04 |
| 1996–1997 | (asma17+asma0)***kopcof***0.04 |
| 1998–2000 | (asma15+asma075+asma0)***kopcof***0.04 |
| 2001 | (asma15+asma05+asma0+asma1)***kopcof***0.04 |
| 2002–2007 | (asma05+asma1)***kopcof***0.04 |
| 2008–2009 | (afa0375+afa04+afa075)***kopcof***0.04 |

*Note*: **kopcof** is the ratio between the market value of the property and the assessed value, observed on the municipality level.

| Pre–tax market income **(tix)** | |
|---|---|
| 1968–2009 | **linc+cinc+einc** |

| Pre–tax total income **(tinc)** | |
|---|---|
| 1968–1977 | snin+**ptax** |
| 1978–1979 | sink7–avuskf+**ptax** |
| 1980–1982 | sinsjo–insjo–avuskf+**ptax** |
| 1983–1990 | sink–avuskf+**ptax** |
| 1991 | jsinkf+**ptax** |
| 1992 | fink+**ptax** |
| 1993–1997 | cfvikis–tsjo+**ptax** |
| 1998–2009 | cfviki+**ptax** |

| Disposable income (**dink**) | |
|---|---|
| 1968–1973 | snin–sslut+**callow+impfp+isoc** |
| 1968–1973 | snin–sslut+**callow+impfp** |
| 1978–1979 | dinkd |
| 1980–1981 | dind+**callow** |
| 1982–1983 | dinu82 |
| 1984–1985 | din84–avuskf |
| 1986–1987 | din86–avuskf |
| 1988–1990 | din88k–avuskf |
| 1991–1992 | din91 |
| 1993–2009 | cdisp |

*Note*: **callow** is the statutory child allowance times the number of children in the household divided by the number of adults in the household (child allowances are included in dinkd but not in dind), **impfp** is the statutory old-age pension for individuals older than 67 years, and **isoc** is imputed social security using 1974 registers.

| Final taxes (**finaltax**) | |
|---|---|
| 1968–1971 | aacc+bacc+**wtax**+**ptax** |
| 1972–1977 | aacc+bacc+fos+**ptax** |
| 1978–1992 | skslut–avegen+**ptax** |
| 1993–2009 | sslut–segen+**ptax** |

| Average tax rate (ATR) | |
|---|---|
| 1968–2009 | **finaltax**/**tinc** |

| Effective tax rate (ETR) | |
|---|---|
| 1968–2009 | (**tix–dink)/(tix)** |